DOCUMENT RESUME

ED 258 751 RC 015 318

AUTHOR Hoch, Irving; And Others
TITLE Real Income, Poverty, Resources. Rural Development, Poverty, and Natural Resources Working Paper Series, Part III.
INSTITUTION Resources for the Future, Inc., Washington, DC. National Center for Food and Agricultural Policy.
SPONS AGENCY Ford Foundation, New York, N.Y.
PUB DATE 83
NOTE 74p.; For related documents, see RC 015 315-321.
AVAILABLE FROM National Center for Food and Agricultural Policy, Resources for the Future, 1616 P Street, N.W., Washington, DC 20036 (free).
PUB TYPE Information Analyses (070)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS Agricultural Occupations; Coal; Comparative Analysis; *Cost Indexes; Differences; Economic Factors; Government Employees; *Income; Low Income Counties; Mining; Minority Groups; *Natural Resources; *Poverty; Poverty Areas; *Quality of Life; Regional Characteristics; *Rural Areas; Rural Population; Rural Urban Differences; Teacher Salaries; Wages
IDENTIFIERS *Cost of Living; Economic Indicators

ABSTRACT

This paper reports progress on the development of improved measures of income and poverty by accounting for differences in living costs between regions, and on the tracing of relationships between natural resources and income; a reviewer's comments conclude the contents of this workshop collection. The overview describes how a measure of income was developed incorporating a quality-of-life (QOL) index--determined from regional factors--and how it was applied to income data from all 3,140 counties in the United States. Following the overview, sections apply the QOL index to income and poverty. The QOL index is then used to help describe interrelations between income and natural resources by citing three pilot studies which focus on per capita income related to coal production in Kentucky, patterns of irrigated land use in agriculture, and off-farm work and government payments in agriculture. The conclusion considers some critiques of wage differential analysis and of quality-of-life deflation and covers some key implications of the approach. Comments suggest a more "micro" data base for wages and occupations, a more detailed hedonic model, a simultaneous equation framework, and further conceptual development for such measurements. (PM)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED258751

Rural Development, Poverty, and Natural Resources
Workshop Paper Series

Part III

Real Income, Poverty, and Resources

Irving Hoch, Julie Hewitt, and
Vicky Virgin
with comments by Edna Loehman

BEST COPY AVAILABLE

JUL 1985
RECEIVED
ERIC/CRESS

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Kenneth R. Farrell
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
✓ This document has been reproduced as received from the person or organization originating it.
Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

RC015318

National Center for Food and Agricultural Policy
RESOURCES FOR THE FUTURE, INC.
1755 Massachusetts Avenue, N.W.
Washington, D.C. 20036

Rural Development, Poverty, and Natural Resources
Workshop Paper Series

Part III

Real Income, Poverty, and Resources

Irving Hoch, Julie Hewitt, and
Vicky Virgin
with comments by Edna Loehman

National Center for Food and Agricultural Policy
RESOURCES FOR THE FUTURE, INC.
1755 Massachusetts Avenue, N.W.
Washington, D.C. 20036

PREFACE

In the summer of 1983, with a grant from the Ford Foundation, Resources for the Future convened a workshop on "rural development, poverty, and natural resources." Over forty leading researchers and community development leaders participated in the two-and-a-half day workshop. Workshop discussions were organized around ten commissioned papers, commentators' remarks, and a luncheon address. The papers covered broad issues of rural development, resource ownership and use, and the incidence of poverty and its relationship to natural resources including six case studies focusing on specific resources in various geographic settings.

The workshop papers and the comments on them are available in a six-part series as follows. An overview paper summarizing the key topics and issues discussed will be available in the spring of 1984.

Part I

Sociodemographic and Economic Changes in Rural America, by Kenneth L. Deavers and David L. Brown, Economic Research Service, U.S. Department of Agriculture; with *comments* by Ronald C. Powers, North Central Regional Center for Rural Development, Iowa State University.

Rural Policy: An Independent View, by Edward J. Blakely, Institute of Government Studies, University of California, Berkeley.

Part II

Income Distribution, Poverty, Natural Resources, and Public Policies: Conceptual and Research Issues, by Emery N. Castle and Mark Goldstein, Resources for the Future, Inc.; with *comments* by Philip M. Raup, Department of Agricultural and Applied Economics, University of Minnesota.

Part III

Real Income, Poverty, and Resources, by Irving Hoch, Julie Hewitt, and Vicky Virgin, Resources for the Future, Inc.; with *comments* by Edna Loehman, Department of Agricultural Economics, Purdue University.

Part IV

Ownership Patterns of Natural Resources in Rural America: Implications for Distribution of Wealth and Income, by Marion Clawson, Resources for the Future, Inc.; with *comments* by Robert G. Healy, Conservation Foundation.

Part V

The City House and the Country House: Land-Use Policies and Rural Poverty in the Northeast, by Frank J. Popper, Resources for the Future, Inc.

Coal, Poverty, and Development Policy in Eastern Kentucky, by Cynthia L. Duncan and William A. Duncan, Mountain Association for Community Economic Development.

Development and Management of Forest Resources for Rural Development in the Pacific Northwest, by Joe B. Stevens, Department of Agricultural and Resource Economics, Oregon State University.

Natural and Human Resources: Major Public Policy and Minority Rural Land Ownership, Management, and Use, by T. T. Williams, Richard Morse, and Avery Webber, Tuskegee Institute; with *comments* by Paul Barkley, Department of Agricultural Economics, Washington State University; Brady J. Deaton, Department of Agricultural Economics, Virginia Polytechnic Institute and State University; and Marty Strange, Center for Rural Affairs.

Part VI

Water and Poverty in the Southwest, by Helen Ingram, University of Arizona; F. Lee Brown, University of New Mexico; Gary Weatherford, Santa Clara University; Gil Bonem, the Center for Natural Resource Studies; Steve Mumme, Colorado State University; and Wade Martin, University of New Mexico.

Indian Natural Resource Development: The Impact on Poverty: Overview of Issues, and Proposals for Research by Susan Williams, Fried, Frank, Harris, Shriver and Kampelman; with *comments* by John Folk-Williams, Western Network, and Allen V. Kneese, Resources for the Future, Inc.

The six-part series and the overview paper are available from: the National Center for Food and Agricultural Policy, Resources for the Future, Inc., 1755 Massachusetts Avenue, N.W., Washington, D.C. 20036.

Kenneth R. Farrell, *Director*
National Center for Food and Agricultural Policy

REAL INCOME, POVERTY, AND RESOURCES

by Irving Hoch, Julie Hewitt, and Vicky Virgin

I. Overview

This paper is a progress report on a project with two major phases.[1] The goal of the first is the development of improved measures of income and poverty by accounting for differences in living costs between regions, while that of the second is the tracing out of relationships between natural resources and income. It is the presumption that success in the first phase will improve the chances for success in the second. A considerable amount of work has been carried out in that first phase, and some preliminary pilot studies have been developed for the second, with both sets of results summarized in this paper.

Following this overview section, which presents key arguments and results in brief fashion, individual sections are devoted to income, poverty, and resources. A concluding section considers some implications of the results and presents some suggestions for future research.

In making income comparisons, most people can draw on personal experience to confirm the observation that a dollar in New York City does not buy as much as a dollar in the rural South. That casual observation can be generalized to the proposition that there are significant differences in the cost of living by locale, and further, that those differences have important consequences for measurement, analysis, and policy. In particular, there is a considerable body of evidence to support the hypothesis that the cost of living generally increases with size of place

---

Irving Hoch directed the work on the project reported on in this paper and was assisted by Julie Hewitt and Vicky Virgin in developing data and carrying out analyses. Laurent Ross wrote a computer program utilized in the work, and Chang-Hua Chiang furnished assistance in computer operations. Phillip Martin, Rosanna Joseph, Leonardo Villalon, Stanley Berns, and Christian Herbst coded, keypunched, and verified data. John Mankin typed the manuscript.

and is lower in the South than in the North. Consequently, comparisons of per capita money incomes, without accounting for putative cost-of-living differences, appear likely to overstate any gap that exists between rural and urban, or between metropolitan and nonmetropolitan incomes. Because resource extraction activities are more nonmetropolitan than metropolitan, evaluations of incomes and returns in those activities are likely to be more pessimistic than would be the case if we had "real" or deflated measures. Again, the problem of nonmetropolitan poverty, relative to metropolitan, may easily be overstated, since the usual measures of poverty do not give much recognition to differences in cost of living between places. (Some farm-nonfarm cost differences, previously distinguished in Census Bureau measures of poverty, are no longer calculated, eliminating even that limited official recognition of geographical differences.)

Cost-of-living indexes can take several forms. The conventional version consists of an index obtained from a standard "market basket" containing a fixed collection of goods and services consumed by the average or typical consumer. Local area prices for those commodities must be obtained and the cost of the market basket then calculated to derive a local area index relative to the market basket's average cost nationally. Although there has been considerable interest in the development of local area conventional indexes, progress has been limited, in large part because of cost and complexity. Further, because consumption patterns vary considerably across the country, the fixed market basket assumption can lead to distorted results. The Bureau of Labor Statistics (BLS) has developed some alternative level-of-living indexes by specifying a particular level of well-being and then estimating the sum of expenditures on particular commodities that will yield that level. The coverage, however, is quite limited and consequently, only limited inferences can be developed from those data.

An alternative source of inferences on geographic variations in the cost of living is afforded by evidence on wage rate differentials for a specific occupation. The kinds of arguments drawn on for this approach are as follows.

At equilibrium, if wage rates for the same work differ between locations, the differences must be compensatory. Thus, people working in a more costly or more harsh environment must be compensated for those condi-

tions, or they will not work in that location. As settlement size increases beyond some point, land prices and rents will be bid up, because more people wanting to locate at a point in space is equivalent to an upward shift in the demand for land. But increases in rent will have multiplier effects; the butcher, the baker, and the candlestick maker must pay higher rents also, and so must charge higher prices for the commodities they sell to local residents. In addition to these market-basket items, which will drive up the cost of living, as conventionally measured, there are a number of both good and bad consequences of increased size of settlement. The good includes the benefits of increased specialization, which becomes economically more feasible as population size increases. Consumers then have better access to specialized services, such as specialized medical care. The bad includes increases in a variety of forms of pollution and congestion that come with increased size of place or its concomitant, increased population density. Density, or population per unit of land, should increase because as the price of land increases, people will economize in its use. Available evidence suggests that the bad generally outweighs the good, in practice, so the wage differential typically is somewhat greater than a corresponding conventional cost-of-living index. This difference can be viewed as making the wage differential results more accurate than the conventional counterpart, because "unconventional" items affecting well-being are included. The unconventional items, such as time spent in the journey to work, are not valued directly in market transactions, but are accounted for indirectly by compensatory changes in wage rates. Hence, we employ "quality of life" (QOL) indexes to designate indexes based on wage differentials, and to distinguish them from the less inclusive conventional cost-of-living indexes.

Besides size of place, wage rate differentials typically are related to region and other geographic characteristics. In many cases, the differences that emerge can in turn be related to such factors as good or bad climate, or to natural hazard such as earthquakes. A key question in interpreting the wage differentials as QOL indexes is the reasonableness of the assumption of labor market equilibrium. Although the real world is always somewhat out of equilibrium, the weight of the evidence suggests that the assumption is indeed reasonable. There may be some nagging doubts

in the case of estimated regional differences, but even here, errors seem likely to be small. These conclusions are drawn from the basic consistency of results in a number of studies of wage differentials for the same work, despite considerable diversity in coverage and disagreements on finer points of doctrine and interpretation. Some details on this literature appear in the next section.

Most of those previous studies employed metropolitan area data and relatively small samples. The present study aimed at an extension of knowledge by the detailed consideration of nonmetropolitan as well as metropolitan areas. It did that by employing samples covering all, or at least very many, of the 3,140 counties of the United States. Wage differentials for each sample were related to geographic characteristics by means of regression equations, with statistically significant results the rule. A detailed comparison of results for the individual samples was employed to assign estimated index numbers in an overall relation. The overall relation was then used in an admittedly daring manner to assign QOL indexes to each county of the United States on the basis of its geographic characteristics. Those indexes, in turn, were used to deflate per capita income and a number of related measures, affording estimates of "real" income by locale and of "real" differences in income between locations.

The samples employed in estimating wage differentials were selected on the basis of good nonmetropolitan area coverage and on having occupational groups as homogeneous as possible. The latter condition reflected an attempt to avoid spurious relationships. For example, if educational level in a given occupation increased with size of place, results for that occupation would likely be misleading. We would be prone to exaggerate the increase in cost of living with population size, since some of the measured effect would likely be attributable to the educational difference. Specific samples employed included eight occupations listed in the 1970 Census of Population; samples of school teacher salary schedules for 1975, 1979, and 1981; and samples of salary schedules of municipal workers (police, firemen, and sanitation workers) for 1979. The use of salary schedules (minimum, or entry level, and maximum wage rate) is preferable to average wages because it avoids problems of differing mixes of training, experience, and seniority between locations.

Though the source of the samples was diverse, results were quite consistent in basic pattern. Further, results were not only consistent among estimated wage rates for diverse occupations, but also seemed generally consistent with the geographic pattern of per capita incomes in each of the years 1973, 1978, and 1981. Given those results (tables 1 through 6 in the next section), the following set of scale factors was assigned to express the discerned basic pattern:

Market Area Size Class	Population in Thousands	Scale Factor for Deflation
1	<1	1.100
2	1-<2.5	1.070
3	2.5-<5	1.050
4	5-<10	1.030
5	10-<25	1.026
6	25-<50	1.050
7	50-<100	1.090
8	100-<250	1.100
9	250-<500	1.120
10	500-<1000	1.150
11	1000-<9000	1.230
12	>9000	1.400
Regions		
Northeast		0.990
North Central		1.050
South		0.900
West		1.060
Alaska		1.400
Hawaii		1.050
Nonmetro Areas		
Contiguous		0.975
Noncontiguous		0.950

As a preliminary to considering these results, some definitions should be noted. Market areas are defined on a county basis and consist of individual counties for nonmetro areas or groups of counties for metro areas, expressing the definition of the metro areas. Metropolitan areas are defined as sets of counties surrounding a central city of 50,000 or more inhabitants, and in effect, constituting a local labor market. The

metro-nonmetro classification is on a county basis; in contrast, the urban-rural distinction involves a much finer grain of geographic analysis. Urban areas include places (cities, towns, and unincorporated areas) of over 2,500 population plus any closely settled territory around a central city of 50,000 or more inhabitants. Rural areas are then the more sparsely settled areas. Thus, there is often considerable rural territory encompassed within the counties comprising metro areas, and nonmetro counties often include small cities and towns. The market area definition we employ here is consistent with the notion that for nonmetro areas, the county corresponds well to the local labor market. In practice, this mode of measurement has yielded good results, and further, those results have generally been superior to results obtained using other measures, such as population density or the population of the largest place in a county.

Twelve sizes of market areas were distinguished, and each county was assigned to a particular size class on the basis of the population of its market area, ranging from 1,000 or less to 9 million or more (the New York City metro area). Since observations were on a county basis, a given metropolitan area would have a number of counties that used its population in their classification. For example, with data on all counties, there would be nine observations falling in market area size class 12, since there are nine counties in the New York City metro area.

The scale factors shown above express a U-shaped relation for wage rates as a function of size of market area, with wages first falling and then increasing as population size increases. This pattern was not universal in the results for our individual samples, since an alternative pattern of invariant (or monotonic) increases with size was almost as prevalent. However, cases to which we gave the most weight involved the U-shaped pattern; further, some independent outside evidence also pointed to the U-shaped pattern, so that pattern was employed. In contrast, the increase in wage rates with size of place beyond the minimum point was pronounced and universal in all our samples.

The increase in the scale factor that occurs as size classes decrease below size class 5 (10,000 to 25,000 population) seems an interesting and perhaps important result, since it suggests that there is an optimal size of settlement. Higher costs with lower size may be explainable by several factors including: diseconomies of scale for small size; higher transpor-

tation costs with increasing isolation and remoteness that are often associated with small size; or higher prices by way of local monopolies that arise because of limited competition in small places. The existence of an isolation effect could be explored by introducing additional variables such as distance to the nearest central city of a metropolitan area. However, we did include some related geographic characteristics for nonmetro counties in the form of a contiguous-noncontiguous classification. This refers to proximity to metro areas, with contiguous counties being those that border on metropolitan areas and noncontiguous counties those that do not. Contiguous counties were estimated to have somewhat lower wage rates for the same work, interpreted as reflecting the cost of living, than di metro counties, while noncontiguous counties had even lower wage rates. These results may be explainable by the hypothesis that the influence of the metro area price structure extends beyond county boundaries, but tapers off with distance from the central city.

A final set of cost-of-living effects is ascribed to region, and to the special cases of Alaska and Hawaii. It is possible that some portion of the regional effects reflect temporary disequilibrium conditions, but available evidence suggests that the basic patterns shown are reasonable, so that any errors are likely to be modest.

Given the listed scale factors, a composite scale factor was obtained for each county by forming the product of the scale factors applicable to it. It is important to note that the product of the scale factors for size class 5 (1.026) and the contiguous nonmetro class (0.975) equals 1.000, so this combined category becomes our base case in the deflation of money income. This might be viewed as consistent with the often-cited preference of people to live in a small town near a large metropolitan area. The regional base can be interpreted as the U.S. average. Because of the characteristics of our base case, when deflation is carried out the resulting real income obtained is somewhat less than the original money amount. The difference can be viewed as the compensation needed both to reimburse people for living in places above the optimal (the urban disamenity) and below the optimal (the rural disamenity). Alternatively, of course, the deflated figure could be easily adjusted to just equal the original amount, or--as generally done here--comparisons can be presented as percentages of the U.S. average or some other base case.

In practice, deflation by the composite scale factor, interpreted as a quality-of-life index, yielded a number of results of note. In presenting the results, values before deflation are termed "nominal," and those after deflation are termed "real." The most noteworthy results are:

1. Treating U.S. average per capita income as equal to 100, metro and nonmetro values in 1981 were:

	Nominal	Real
Metro areas	107.5	103.3
Nonmetro areas	80.5	91.7

Put more succinctly, nonmetro as a percent of metro per capita income was 74.9 in nominal terms, and 88.8 in real terms. Hence, the income gap between metro and nonmetro areas is narrowed, but not removed by deflation.

2. Defining low-income families as those with incomes under $7.500 in 1979, the following comparisons emerge for low-income families as a percent of all families in each group, relative to each group's total of 100 percent:

		Nominal	Real
Whites	Metro	9.3	12.3
	Nonmetro	15.3	15.3
Blacks	Metro	28.5	33.5
	Nonmetro	37.6	34.7
American Indians	Metro	21.7	26.6
	Nonmetro	31.1	32.6
Hispanics	Metro	22.9	28.7
	Nonmetro	26.3	26.6

Thus, about 33 percent of Black and American Indian families in nonmetro areas have incomes below $7,500, whether measured in nominal or real terms. This is more than double the percentage for white families. With deflation, the metro-nonmetro difference narrows for Whites, Blacks, and American Indians, but in each case, remains higher in nonmetro than in metro areas. The Hispanic relation reverses, however, with a higher metro fraction in the case of real income. In comparing real to nominal levels, the fraction of low-income nonmetro families increases for American Indians, decreases for Blacks, and is stable for Whites and Hispanics.

3. Of the 50 poorest counties as of 1973, Kentucky led with 19, measured by nominal per capita income, and still led with 14, when measured by real per capita income. Deflation caused a number of western counties to replace southern counties. New Mexico's count increased from 1 to 5 counties.
4. Of the 314 poorest counties in 1973 (the lowest decile in terms of real per capita income), 11 had higher per capita incomes than the U.S. median level in 1981. Of those, one was in Colorado, 2 in Louisiana, and 8 in Texas. Nine of the 11 were energy producers, and one (Mineral County, Colorado) was a major mineral producer, as befitted its name (with production of copper, silver, zinc, lead, and cadmium).
5. Income maintenance transfers per capita were as follows in 1981:

	Nominal	Real
Metro	$160.4	132.6
Nonmetro	136.4	138.2

Hence, nonmetro as a percent of metro was 85.0 percent in nominal terms and 104.2 in real terms. What little gap there was between metro and nonmetro, when measured in real terms, favored the nonmetro areas.

6. An examination of Kentucky coal production yielded the conclusion that increases in per capita income from an expansion of coal production were considerably greater in real than in nominal terms. In fact, in 1970, measuring in nominal terms led to the conclusion that expansion of Eastern Kentucky coal production would reduce money income; measuring in real terms implied that such expansion would increase real income.
7. Per capita income in Kentucky coal producing counties was sensitive to both coal price and quantity produced, increasing with each. The impact of coal production on income was much stronger after 1973 than before, even after accounting for higher prices. This may well be a multiplier effect, with higher income from coal production generating higher income throughout the Kentucky economy.

8. Irrigated acreage as a fraction of acreage in crops was somewhat higher in low-income counties than in high-income counties in the western United States. For the country as a whole, no pattern was manifest. The western results might reflect (a) the location of government-subsidized irrigation projects in low-income counties to raise incomes or (b) the greater employment of low-income people on large irrigated farms than on dryland farms. The fraction also increased with increasing urbanization, suggesting that levels of irrigation increase as the availability of municipal-industrial water supply increases.
9. Days of work off-farm for farm operators increased with urbanization, which appears in line with the T.W. Schultz hypothesis that farm markets work better near urban complexes. However, days of work off-farm also decreased as real income increased, probably reflecting greater concentration in farming and less need for off-farm income.

In addition to these contributions to measurement, the wage differential approach to QOL estimation yields a number of important insights. Some of particular interest include the following:

1. Current population shifts, from frostbelt to sunbelt, and from metro to nonmetro places (the rural turnaround), involve movement from places of higher money wage rates to those of lower money wage rates. But the shifts are best interpreted as movement from places of lower to those of higher real wages.
2. The shift of population to places of lower cost of living suggests that the measured slowdown in the growth of productivity may understate real growth.
3. Adjusting nominal to real income will better identify the truly needy and aid in targeting assistance to the poor.
4. Because resource extraction tends to occur in nonmetro areas, real returns to those activities typically will exceed nominal returns, so evaluation of investment in the activities will have a negative bias.
5. Choice of alternative public investments across the country may err by calculating money and not real returns. In particular, there may be overinvestment in large places in the North, and

underinvestment in small places in the South. (Alternatively, this seems a counterargument to the complaint by a number of northern states with large urban populations that they are shortchanged in the location of federal expenditures.)

Finally, improved measurement of income will help in distinguishing and analyzing income-resource relationships. In particular, the following high-low cross-classification may yield some useful hypotheses:

1. High resource endowment, high income. Many examples of figurative (and some literal) gold mines can be noted.
2. Low endowment, low income. Cases include situations of resource depletion, and groups with low levels of inputs generally, including land.
3. Low endowment, high income. An evolutionary process can occur in some harsh environments so that only the economically able "survive" as viable enterprises.
4. High endowment, low income. Some resource-rich activities draw heavily on low-skilled labor, for example, plantation agriculture. Again, there may be unexploited opportunities. Many American Indian tribes have considerable water and mineral resources that appear far from being properly utilized.

The testing of hypotheses drawn from that classification can be helped by the improved income measures developed here.

II. Income Comparisons

The Literature

A number of observers have recognized the need for area specific cost-of-living adjustments. For example, Luther Tweeten has argued that adequate comparisons of either absolute or relative deprivation among sectors and areas are impossible without such adjustments.[2] Again, a National Academy of Sciences Panel on Rural Development Policy recommended the development of a rural cost-of-living index to provide annual indicators of differentials between rural and urban areas, and thus furnish a proper basis for comparison of the economic well-being of target groups.[3] The Urban Institute has issued a report concluding that the construction of rural cost-of-living indexes is feasible, and outlining the methodology for

that construction.[4] Vinod Thomas developed some relatively simplified cost-of-living indexes for both Peru and Brazil, and concluded for both countries that adjusting for cost-of-living differences reduced urban-rural variation considerably, though measured levels of poverty remained stronger in rural than in urban areas.[5] It thus seems likely that the case for cost-of-living adjustments extends beyond the United States, and could well be worldwide in applicability.

Little in the way of local area conventional cost-of-living indexes is currently available for the United States. As noted earlier, the BLS has developed level-of-living indexes consisting of budgets required to attain a particular living standard.[6] However, the coverage is limited, consisting of readings on thirty-nine metropolitan areas and four nonmetropolitan urban areas, covering each major census region. To illustrate the information appearing in those series, comparative costs for a moderate standard of living in the nonmetro urban areas were as follows in 1967, relative to an urban average cost of 100:[7]

U.S. nonmetro (all regions)	92
Northeast nonmetro	99
North Central nonmetro	94
South nonmetro	86
West nonmetro	98

Such values yield useful benchmarks but the coverage is generally too limited for detailed analysis.

As noted earlier, there are serious constraints on the construction of more detailed local area cost-of-living indexes, with a primary deterrent that of cost. In 1977, a committee of federal statistical agencies argued that the collection of local area price data was extremely costly, and that the Congress had never seriously considered the need for such data, making their collection questionable.[8] Robert A. Hoppe has cited several estimates on the difficulties and costs that would be incurred by the BLS in developing local area cost-of-living indexes, noting that a cost of $50 million (and an elapsed time of five years) appeared reasonable.[9] Despite these constraints, the Panel on Statistics for Rural Development Policy did recommend that the BLS develop rural cost-of-living indexes;[10] and, in fact, the BLS was recently engaged in an extensive effort to develop detailed information for local area indexes. However, the funding for that

project has been withdrawn, and the work terminated.[11] It is of interest, however, that the Department of Defense is now considering the construction of local area cost-of-living indexes through the application of wage differentials.[12] These correspond to what we have termed QOL indexes.

There is a considerable literature on wage differentials by size of place and by region. Some representative citations include papers by Alonso, Fuchs, Hoch, Izraeli, Meyer and Leone, Nordhaus and Tobin, Power, and Tolley.[13] Papers by Cropper and Arriaga and by V.K. Smith develop evidence that increased levels of air pollution are associated with increased money wage rates, and there is considerable evidence that air pollution increases with size of place.[14] Several studies of migration show migrant behavior that is consistent with real income rather than money income differences by size-of-place; examples include a study by Deaton, Morgan, and Anschel of rural-to-urban migration and studies by Stevens of metro-to-nonmetro migration.[15]

Wage Rate Differentials

The work of the present study extends the previous efforts by analyzing wage rates in nonmetropolitan as well as in metropolitan areas, building on an earlier pilot study of much more limited coverage.[16] Here, samples of wage rates for relatively homogeneous occupations were obtained on a county basis from several sources. The use of the county as the unit of observation is now a standard practice, given the availability of data organized by counties.[17] The sample coverages were as follows:

1. Six male and two female occupations from the 1970 Census of Population.[18] Similar data were not available in the 1980 Census of Population, the information not having been gathered in the more recent census.[19] The male occupations covered were (1) professional and managerial, (2) craftsmen, (3) operatives (primarily factory workers), (4) laborers, other than farm laborers, (5) farm operators and managers, and (6) farm laborers. The female occupations were (1) clerical workers and (2) operatives. In all cases, county coverage was nearly complete, falling a bit below the 3,140 U.S. county total because of nonreporting or nonoccurrence of an occupation in a few counties. Although this geographic coverage is excellent, the occupational coverage leaves

something to be desired, since occupations are so broad that some heterogeneity is likely to occur. The problem seems most pronounced for the professional and farm operator categories.

2. Public school teacher salary schedules in two sets of schedules: (a) 2 state detailed coverage and (b) ERS sample of school districts over the United States. The first set of samples was obtained in response to requests made to all state departments of education; twenty-one states furnished data on salary schedules by individual school district for both the 1975-76 and the 1981-82 school years.[20] The salary schedules consisted of listings of minimum (entry level) and maximum salaries for holders of bachelors and masters degrees, respectively. The second set of school teacher salary schedules was obtained from Educational Research Service, Inc.[21] and consisted of a sample of about 1,000 school districts over the entire country; for each district, there was a listing of the minimum salary for teachers with the bachelors degree, and the maximum salary for teachers with the masters degree. In both sets of samples, the county in which each school district fell was identified.[22]

3. Municipal employee salary schedules. Minimum and maximum salaries for policemen, firemen, and sanitation workers, respectively, were obtained by municipality for 1979 from the International City Management Association.[23] The municipalities were identified by county, and included a number falling in nonmetropolitan areas.

The salary schedule information of groups 2 and 3 appeared particularly useful both because the coverage was for homogeneous groups and because it avoided the problem of differences in worker mix between locations, by seniority or skill, which can arise with the use of average wage rates. Of course, the geographic coverage was less extensive than that of the census data.

For each sample, wages were now related to population size by means of a regression equation. As noted earlier, the unit of observation was the county, and population was measured as the metropolitan area population if the county was a component of a metro area, and as the county population if the county was nonmetropolitan. In both cases, the area employed was viewed as a good approximation of the local labor market and so was termed

the "market area." In addition to population, two sets of geographic explanatory variables were employed. The first set accounted for the four major census regions, and for Hawaii and Alaska, states with a cost-of-living above the average. The second set categorized nonmetropolitan counties as contiguous or not contiguous to metro counties, under the hypothesis that metropolitan influence can extend beyond jurisdictional boundaries.

Two basic equation forms were employed. The first treated population size as a continuous variable and employed both the logarithm of population and the square of that logarithm as explanatory variables, thus allowing minimum or maximum values of predicted wage rates to occur in the fitted equation. Results for that equation form were useful in making inferences and some of those results are presented in an appendix to this paper. The second equation form classified population size into twelve steps or size groups, ranging from under 1,000 persons at one extreme to over 9 million at the other. Because results for this equation form have the advantage in presentation of ease of comprehension, they are shown in the body of this paper.

As a preliminary step, per capita income for each of the years 1973, 1978, and 1981 was related to the population size groups, only, in effect yielding the average per capita income for each group, as shown in table 1. Those results exhibit a U-shaped relation between per capita income and size of market area, with a minimum level generally attained at size class 5, the 10,000 to 25,000 person class. Essentially the same pattern held for per capita incomes when regional and nonmetro area effects were introduced into the equation. Farm income is liable to be an important factor in income levels for the small population size classes; thus the high values for those classes in 1973 probably reflect a very good year for agriculture. Hence, it is possible that at least some of the U-shaped effect represents some special features of the farm economy. It is possible that higher farm incomes occur in areas of smaller population size or that farm incomes per farm resident are above nonfarm incomes per capita. However, wage rates for the same work often exhibit the same sort of U-shaped pattern that holds for per capita income, as shown in tables 2 through 5.

Table 1. Per Capita Income by Population Size Classes, 1973, 1978, and 1981

Market Area Size Class	Pop. in 000	Per Capita Income in Size Category in 1981 Dollars[a]			Indexes of Per Capita Income Relative to Average Income, All Counties			Number of Counties
(----1973----)		1973	1978	1981	1973	1978	1981	
1	<1	12,363	10,129	10,001	138.42	112.35	116.01	24
2	1-<2.5	11,088	9,622	8,867	124.15	106.72	102.86	87
3	2.5-<5	11,306	9,549	8,990	126.60	105.92	104.28	196
4	5-<10	8,962	8,449	8,157	100.34	93.71	94.61	506
5	10-<25	8,191	8,391	8,016	91.72	93.07	92.98	930
6	25-<50	8,138	8,664	8,267	91.12	96.10	95.90	474
7	50-<100	8,661	9,279	8,879	96.98	102.92	102.99	235
8	100-<250	8,924	9,511	9,054	99.93	105.49	105.02	211
9	250-<500	8,997	9,749	9,355	100.74	108.13	108.52	155
10	500-<1000	9,313	9,811	9,442	104.28	108.82	109.53	133
11	1000-<9000	10,521	11,418	11,005	117.80	126.65	127.65	180
12	>9000	12,701	12,739	12,629	142.21	141.28	146.49	9
All Counties		8,931	9,016	8,621	100.00	100.00	100.0	3,140

[a]Simple averages in all cases, including "All Counties," i.e., each county is given equal weight in forming average.

Source: U.S. Bureau of Economic Analysis data on computer tape corresponding to published data in county income series in Survey of Current Business (Revised Series).

Table 2. Estimated Earning Levels and Differential by Locale for Eight Occupations, 1969

Explanatory Variables		Professional & Managerial (Male)	Craftsmen (Male)	Clerical (Female)	Operatives (Female)
Market Area (1969)		Earnings Levels by Size Class, Average = 100[a]			
Size Class	Pop. in 000				
1	<1	82.468	95.319	100.979	102.513
2	1-<2.5	90.749	96.588	88.343	77.557
3	2.5-<.5	96.320	97.575	95.966	9[illegible].452
4	5-<10	98.679	98.143	99.306	100.243
5	10-<25	104.327	102.373	101.221	103.732
6	25-<50	109.935	108.123	105.437	112.314
7	50-<100	115.389	112.023	108.073	113.939
8	100-<250	114.288	114.533	110.605	118.664
9	250-<500	117.855	116.787	113.459	119.092
10	500-<1000	119.364	119.217	115.258	123.136
11	1000-<9000	129.244	127.140	124.103	127.432
12	>9000	141.613	132.239	142.526	126.528
		Area Differentials (Increments)			
Regions					
Northeast		0.000	0.000	0.000	0.000
North Central		-1.940	2.434	-6.547	0.201
South		-10.027	-13.069	-2.524	-8.610
West		-0.198	9.683	-0.140	-16.833
Alaska		22.678	46.775	20.410	8.719
Hawaii		7.869	2.159	26.673	6.937
Nonmetro Areas					
Contiguous		-2.375	-0.336	0.114	1.126
Noncontiguous		-3.563	-6.668	-3.103	-4.822
		Explained Variance and Number of Observations			
R^2		.424	.488	.278	.222
No. of Observations		3,134	3,135	3,135	3,084

[a]Results were obtained from a regression equation for each case shown. Earnings levels were obtained by adding individual size class effects to the constant term in the regression equation. The respective area differentials should be added to each size class to obtain results specific to each area. The average salary in each case is respectively set at 100 to yield the indexes shown.

Table 2 (continued).

Explanatory Variables	Operatives (Male)	Laborers (Male)	Farm Operators & Mgrs (Male)	Farm Laborers (Male)
Market Area (1969)	Earnings Levels by Size Class, Average = 100			
Size Class Pop. in 000				
1 <1	124.235	116.170	183.013	141.413
2 1-<2.5	103.329	110.895	126.303	126.896
3 2.5-<5	98.184	107.417	128.545	125.647
4 5-<10	98.971	106.966	112.059	115.946
5 10-<25	101.097	105.929	114.905	113.104
6 25-<50	104.825	108.508	115.349	113.098
7 50-<100	108.259	110.119	118.865	116.793
8 100-<250	111.311	115.997	114.740	114.998
9 250-<500	114.548	116.118	112.748	115.970
10 500-<1000	116.393	119.649	108.077	121.130
11 1000-<9000	122.158	125.618	116.987	125.918
12 >9000	124.197	146.316	149.316	154.092
	Area Differentials (Increments)			
Regions				
Northeast	0.000	0.000	0.000	0.000
North Central	5.316	-1.374	-0.865	-9.412
South	-15.158	-23.566	-20.003	-21.548
West	9.988	9.508	11.183	4.722
Alaska	27.323	36.832	-19.285	110.552
Hawaii	-11.337	-6.224	-39.461	54.088
Nonmetro Areas				
Contiguous	1.802	3.723	-9.491	-2.202
Noncontiguous	-5.056	-3.349	-11.603	-6.467
	Explained Variance and Number of Observations			
R^2	.361	.319	.136	.146
No. of Observations	3,129	3,126	3,087	3,092

Source: Derived from data on computer tape of 1970 Census Fourth Count Population Employment Count Extract File. See U.S. Bureau of the Census, Census of Population: 1970, General Social and Economic Characteristics, Final Report PC(1)-C1, U.S. Summary and Individual States, Appendix D.

Table 3. Estimated Salary Levels and Differentials by Locale for Police, Firemen, and Sanitation Workers, 1979

Explanatory Variables		Police Min.	Police Max.	Firemen Min.	Firemen Max.	Sanitation Workers Min.	Sanitation Workers Max.
Market Area (1979)		Salary Levels by Size Class, Average = 100					
Size Class	Pop. in 000						
1	<1	-	-	-	-	-	-
2	1-<2.5	-	-	-	-	-	-
3	2.5-<.5	-	-	-	-	-	-
4	5-<10	-	-	-	-	-	-
5	10-<25	82.694	75.477	82.616	74.428	89.631	86.791
6	25-<50	84.891	78.882	87.978	79.353	93.973	88.385
7	50-<100	88.076	85.298	90.068	85.190	98.151	96.625
8	100-<250	92.298	89.469	93.893	88.740	104.018	99.485
9	250-<500	96.186	96.360	98.445	95.387	107.651	103.892
10	500-<1000	98.215	97.620	100.550	98.378	106.650	102.855
11	1000-<9000	105.295	105.773	107.573	105.749	113.921	110.347
12	>9000	108.551	119.643	112.463	122.951	124.824	127.488
		Area Differentials (Increments)					
Regions							
Northeast[a]		0.000	0.000	0.000	0.000	0.000	0.000
North Central		9.040	9.995	9.422	12.359	12.052	11.809
South		-7.987	-6.932	-10.205	-6.043	-21.819	-14.868
West		15.680	16.869	14.720	18.779	6.109	13.447
Alaska		90.362	83.741	94.668	89.085	129.070	92.865
Hawaii		-6.929	-7.951	-13.751	-15.070	3.339	-8.559
Nonmetro Area							
Contiguous		-2.293	-0.476	-3.103	-0.856	-1.458	-1.896
Noncontiguous		-4.440	-1.637	-5.597	-3.939	-0.826	-2.140
		Explained Variance & Number of Observations					
R^2		.554	.597	.571	.606	.522	.505
No. of Observations		1,473	1,456	1,156	1,142	811	801

\- Indicates no coverage.
[a] Omitted variable.

Source: Derived from data on computer tape obtained from International City Managers Association.

Table 4. Estimated Salary Levels and Differentials for Public School Teachers, by Degree and Status, 1979-80 and 1981-82

Explanatory Variables		Bachelors Min.	Masters Max.	Bachelors Min.	Bachelors Max.	Masters Min.	Masters Max.
Market Area Variables (1979 or 1981)		ERS Sample 1979-80		21 State Systems Sample 1981-82			
Size Class	Pop. in 000	Salary Levels by Size Class, Average = 100					
1	<1	-	-	73.767	79.619	71.699	69.358
2	1-<2.5	84.212	93.601	86.963	94.412	83.056	82.426
3	2.5-<5	94.429	76.874	81.734	91.537	80.199	81.676
4	5-<10	91.074	88.071	84.522	93.542	81.785	83.829
5	10-<25	94.179	90.856	84.161	93.155	81.638	84.119
6	25-<50	93.708	93.806	85.086	93.295	83.056	85.618
7	50-<100	94.887	96.310	83.245	93.423	81.254	86.220
8	100-<250	96.389	97.291	84.136	96.059	82.690	89.548
9	250-<500	97.335	98.719	85.584	100.498	85.324	95.500
10	500-<1000	98.338	101.566	87.742	109.040	87.367	103.674
11	1000-<9000	100.271	108.450	89.043	105.675	88.526	105.501
12	>9000	114.507	136.639	105.541	137.834	106.744	132.757
Regions		Area Differentials					
Northeast		0.000	0.000	0.000	0.000	0.000	0.000
North Central		2.393	1.945	18.270	7.340	18.955	16.510
South		0.265	-9.910	13.271	-7.154	14.612	-4.740
West		6.382	6.873	23.765	12.542	25.904	21.841
Alaska		61.178	66.452	-	-	-	-
Hawaii		-9.432	7.220	-	-	-	-
Nonmetro Area							
Contiguous		0.066	-5.078	-0.384	0.495	1.131	1.674
Noncontiguous		-1.149	-4.495	-1.568	-1.201	-0.822	-1.192
		Explained Variance and Number of Observations					
R^2		.262	.487	.475	.305	.425	.535
No. of Observations		1,015	1,015	3,674	3,679	3,645	3,656

- Indicates no data for case.

Sources: ERS Sample - developed from data appearing in Educational Research Service, Inc., ERS Report: Scheduled Salaries for Professional Personnel in Public Schools, 1979-80, Part 1, Arlington, Va., 1980; and Curriculum Information Center, C.I.C. School Directory, 1980-81, Westport, Conn.: Market Data Retrieval, Inc., 1980. The 21 state systems sample was developed from data in individual state reports.

Table 5. Salary Levels for Public School Teachers, by Region, 1981-82

Explanatory Variables		Average Over Degree Categories, 21 State Systems Sample, 1981-82[a]			
		Northeast	North Central	South	West
Market Area 1981 Size Class	Pop. in 000	Salary Levels by Size Class, Average Salary = 100			
1	<1	-	-	-	88.090
2	1-<2.5	-	-	102.160	100.032
3	2.5-<5	-	102.571	97.601	96.580
4	5-<10	-	95.457	98.858	99.552
5	10-<25	102.349	96.278	96.360	103.004
6	25-<50	92.462	97.401	99.351	103.465
7	50-<100	93.659	97.132	99.304	101.194
8	100-<250	100.715	96.683	101.334	97.111
9	250-<500	100.744	101.489	106.691	102.645
10	500-<1000	116.988	101.220	106.859	102.789
11	1000-<9000	107.954	107.780	117.809	104.347
12	>9000	135.928	-	-	-
		Explained Variance & Number of Observations			
R^2		.352	.222	.195	.031
Number of Observations		478	1,614	1,095	455

- Indicates data not available.

[a]Average obtained by sum of salaries for bachelors minimum, bachelors maximum, masters minimum, and masters maximum, divided by 4.

Source: Derived from data in individual reports obtained in response to requests made to all state departments of education.

In reading those tables, note that the levels shown for each size class are relative to the average salary for each occupation, with that average set at 100. To find the salary for a given multiple characteristic category, area differentials should be added to the salary level. For example, in table 2, the estimated salary for female operatives in size class 6, located in the South, in a noncontiguous area equals 112.314-8.610-4.822 = 98.882. In tables 2 through 5, the Northeast region and metro areas are treated as base cases, that is, their effect is set at zero. The tables also include explained variance (R^2) and number of observations; R^2 can vary from 0 to 1; the closer to 1, the greater the explanation of the variability in the wage rate.

Reviewing the results for size of place, there is at least some indication of a U-shaped relation for six of the eight occupations covered in the 1970 Census of Population; the relation is not manifest for the municipal employee results, but the coverage there does not extend to the smallest market size classes; and there is also some limited evidence of a U-shaped relation in the case of the public school teacher results. In the latter case, the U-shaped pattern is considerably stronger when we employ population size as a continuous variable (see the appendix). It is also stronger when results are obtained for each region in turn, as shown in table 5.

In any event, it is clear there is a strong pattern of increasing wage rates with size of place once the minimum threshold has been passed.

Table 6 exhibits an effort to assemble the key relationships of the previous five tables and to make them comparable by using results for size class 5 as a base. Column (7) of that table exhibits an assigned overall relationship, exhibiting an inferred "best set" of readings on wage rates by geographic category.

Although the evidence for a U-shaped relationship is hardly overwhelming, it was chosen for the following reasons. First, it held for what appeared to be the most homogeneous of occupations: operatives, laborers, and farm laborers (table 2) and for entry level school teachers (results shown in appendix). Second, it seemed plausible that there are diseconomies of small scale, expressing limited choice and perhaps isolation and remoteness; and there may be costs imposed by monopoly, as well, because of likely limits on competition, given small size. Such costs could well show

Table 6. Key Relationships Made Comparable and Assigned Overall Relationship

Market Area Size Class	Pop. in 000	1978 Per Capita Income (1)	1970 Labrs. Ernngs. (2)	1970 6 Occ. Ernngs. (3)	Teachs. Sals. ERS 1979-80 (4)	Teachs. Sals. 21 States 1981-2 (5)	Munic. Occ. Sals. 1979 (6)	Assigned Overall Relationship (7)
		Levels by Size Class, Based on Size Class 5						
1	<1	114.89	112.92	110.52	100.87	89.09	-	110.0
2	1-<2/5	109.60	107.61	98.63	92.49	103.22	-	107.0
3	2.5-<5	110.85	104.12	100.58	99.41	100.44	-	105.0
4	5-<10	102.27	103.69	101.30	102.62	102.72	-	103.0
5	10-<25	102.62	102.62	102.62	102.62	102.62	102.62	102.6
6	25-<50	105.40	105.22	106.78	104.60	103.72	107.21	105.0
7	50-<100	111.23	106.83	109.61	106.88	103.11	112.99	109.0
8	100-<250	109.62	112.74	112.44	108.16	105.64	117.90	110.0
9	250-<500	112.33	112.87	114.09	109.56	109.90	123.91	112.0
10	500-<1000	112.82	116.42	117.24	112.02	116.02	125.19	115.0
11	1000-<9000	127.37	122.42	123.52	117.79	116.24	134.08	123.0
12	>9000	141.95	143.14	135.83	143.77	142.50	147.55	140.0
Regions			Area Differentials (Increments)[a]					
Northeast		-0.66	3.88	2.44	-0.63	-10.01	-4.13	-1.0
North Central		5.37	2.50	4.01	1.61	5.80	8.83	5.0
South		-11.16	-19.81	-11.71	-7.53	-7.74	-17.72	-10.0
West		6.45	13.44	5.27	6.55	11.95	13.02	6.0
Alaska		29.77	37.03	41.96	69.19	-	116.15	40.0
Hawaii		5.17	-6.26	12.10	1.66	-	-9.80	5.0
Nonmetro Areas								
Contiguous		-5.99	3.74	0.71	-3.56	1.192	-2.02	-2.5
Noncontiguous		-7.24	-3.37	-4.93	-3.59	0.506	-3.72	-5.0

[a]Area differentials are relative to the U.S.; in tables 2 through 5 they are relative to the Northeast region.

Sources: (1) From table 1. (2) Laborers earnings from table 2. (3) The 6 occupations averaged are those of table 2 excluding Professional & Managerial and Farm Operators & Managers. (4) From regression results using the average of the cases in the ERS section of table 4. (5) From regression results using the average of the cases in the 21 state sample section of table 4. (6) Average of cases in table 3, covering police, firemen, and sanitation workers. (7) Derived on the basis of (1) through (6).

up in wage rates. Some evidence of this effect appears in Wyoming teacher salary schedules for 1975-76; thus, Fremont County gave teachers living in isolated areas a pay raise of 6 percent; Campbell County made isolation payments of $250 to $600, although no payment was allowed in schools less than 20 miles from the town of Gillete; and as a last example, Sheridan County had a rural school allowance of $200 per year for isolation, which contrasted with $180 per year for janitorial duties.[24] Finally, Dahmann presents evidence from considerably diverse sources that nevertheless squares well with our results here.[25] Dahmann used preference responses on neighborhood conditions reported in the 1976 Annual Housing Survey conducted by the U.S. Census, and found that neighborhood satisfaction by size of place was highest in urban places of 10,000 to 25,000, declined steadily with increasing size, and was somewhat lower in places below 10,000 population. His results for nonmetro places can be summarized as follows, in terms of percentages of respondents making specified ratings:[26]

Rating of Neighborhood	Population Size in thousands		
	25-50	10-25	<10
	Percentages		
1) Excellent or good	82.7	87.2	83.8
2) Fair or poor	17.2	12.8	16.2

In contrast, metro places over 3 million population had responses of 62.7 percent and 37.3 percent for categories (1) and (2), respectively.

The inferred results for the other geographic characteristics shown in column (7) of table 6 do not seem as clear-cut as those for size of place, based both on consistency of pattern and statistical significance. (Size-of-place effects were always strongly significant; many of the other effects often were not.)

Nonmetro areas that were not contiguous to metro areas generally had wage rates below nonmetro areas that were contiguous, which in turn typically had wage rates below those of metro areas. These differences were interpreted here as cost-of-living effects, though they could also be interpreted as conforming to the urban-industrial impact hypothesis of T.W. Schultz,[27] which argues that markets work better and real incomes are higher for people located near an urban-industrial complex. In contrast, it is our hypothesis here that the higher cost structure generated by

higher urban land prices extends beyond the formal boundaries of metro areas. Some support for our hypothesis is afforded by the more likely conversion of land from rural to urban uses, the closer one is to a metropolitan area.

The Southern wage differential was always negative, but was more strongly negative for low- than for high-skilled occupations, perhaps indicative of a long-term disequilibrium in process of slow correction, or possibly a reflection of different conditions and preferences for different occupations.[28] The North Central and Western differentials were generally positive, while that for the Northeast seemed close to zero. Available evidence suggested that between 1970 and 1981 there has been a small upward shift for the Southern regional differential, and a small downward shift for the Northeast, somewhat narrowing the gap between North and South. Those relatively modest shifts were incorporated in the inferred overall relationship appearing in column (7) of table 6. (In that table, the regional differentials are measured relative to the U.S. average level.) It is possible that the recent shifts may be transient. That possibility and the question of marked occupational variations in regional differentials, noted for the South, seem deserving of further probing in future research.

Deflation of Income

The components of the overall relationship were now treated as scale factors to be used to deflate income and other variables measured in money terms. In particular, the base case in practice was a market area of 10,000 to 25,000 population (size class 5) located in a contiguous nonmetro area, for the scale factor for that combination was 1.026 times .975, equal to 1.000. The product of the appropriate scale factors for each county was labeled the quality-of-life (QOL) index to distinguish it from a conventional cost-of-living index. Note that an increase in the QOL index means that the quality of life has gone down, necessitating a compensatory payment corresponding to the QOL level of disamenity. Table 7 exhibits per capita income before and after QOL deflation for the United States and for metro and nonmetro areas for each of the years 1973, 1978, and 1981. Metro and nonmetro per capita incomes as percentages of the U.S. average are also shown. Some conclusions drawn from table 7 are:

Table 7. Comparisons of Per Capita and QOL Deflated Per Capita Income for Metro and Nonmetro Areas, in 1981 Dollars

	1973	1978	1981
	Per Capita Income (weighted average)		
U.S.	10,249.9	10,842.2	10,494.8
Metro areas	10,902.1	11,609.1	11,283.1
Nonmetro areas	8,508.1	6,348.6	8,454.2
	Per Capita Income Deflated by QOL Index		
U.S.	8,948.3	9,480.8	9,175.9
Metro areas	9,131.6	9,746.3	9,475.9
Nonmetro areas	8,459.2	8,792.6	8,399.3
	Per Capita Income as Percent of U.S.		
U.S.	100.0	100.0	100.0
Metro areas	106.4	107.1	107.5
Nonmetro areas	83.0	81.6	80.5
	QOL Deflated Per Capita Income as Percent of U.S.		
U.S.	100.0	100.0	100.0
Metro areas	102.0	102.8	103.3
Nonmetro areas	94.5	92.7	91.7

(1) The gap between metro and nonmetro income is narrowed considerably by deflation. In both 1978 and 1981, nonmetro per capita income as a percentage of metro was approximately 75 percent in money terms, and 89 percent in "real" terms (that is, in 1981, 80.5/107.5 = 74.9, and 91.7/103.3 = 88.8).[29]

(2) The choice of base case reflected a combination of "optimal" size of place and location near a metro area. (Dahmann cites a number of studies that establish a general preference for location in a small place within easy access of a large urban center.[30]) Per capita real income was .8730 of money income in 1973, and .8743 of money income in 1981. The difference can be interpreted as a measure of compensatory income related to location; that is, 13 percent of income can be interpreted as a premium compensating people for location at other than the base case location.

(3) There was a small upward shift in the ratio of real to money income from 1973 to 1981 (amounting to .8743/.8730 = 1.0015). This may be interpreted as reflecting changes in the distribution of population, including frostbelt to sunbelt shifts and the "rural turnaround" (nonmetro population growth rate now somewhat above the metro rate). The relative shift to places of lower costs of living can imply some understatement in the current rate of growth in productivity, and some overstatement of past productivity growth during the period when large urban places were growing faster than the rest of the country. The effect admittedly appears modest. Nevertheless, recent concern about declining growth in productivity could be somewhat overdrawn.[31]

Table 8 makes use of Brown-Hines codes to compare per capita income before and after deflation by the QOL index. The Brown-Hines codes are a county population classification device developed by the USDA and involving a cross-classification of metro-nonmetro and urban-rural characteristics.[32] The codes run from 0 to 9, with 0 through 3 designating metropolitan counties, and 4 through 9 designating nonmetropolitan counties. The codes have the following definitions:

Table 8. Comparisons of Per Capita and QOL Deflated Per Capita Income in 1981 by Brown-Hines Codes

	Per Capita Income In Dollars		Per Capita Income Deflated by QOL Index	
U.S. Average	10,494.8		9,175.9	
Brown-Hines Code				
0,1	12,095.2	12,235.6	9,617.5	9,828.5
2	10,449.2		9,328.1	
3	9,642.6		8,927.3	
4,5	9,024.1	9,028.5	8,542.5	8,874.2
6,7	8,198.5	8,251.9	8,254.9	8,454.5
8,9	7,358.7	7,696.6	7,644.7	7,861.5
	As Percent of U.S. Average			
U.S.	100.0		100.0	
Brown-Hines Code				
0,1	115.2	116.6	104.8	107.1
2	99.6		101.6	
3	91.9		97.3	
4,5	86.0	86.0	93.1	96.1
6,7	78.1	78.1	90.0	92.1
8,9	70.1	73.3	83.3	85.7

Source: County per capita income data from Bureau of Economic Analysis (BEA) data on computer tape (see table 1).

Code	Metropolitan Counties: Metro Population in 000	Other Characteristics
0	>1,000	Central city in county
1	>1,000	Suburban county
2	250-<1,000	
3	<250	

	Nonmetropolitan Counties: Urban Population in 000	Location With Respect to Metro Area
4	>20	Contiguous
5	>20	Noncontiguous
6	2.5-<20	Contiguous
7	2.5-<20	Noncontiguous
8	<2.5	Contiguous
9	<2.5	Noncontiguous

Information employing the Brown-Hines codes seems most comprehensible if it is organized in the following manner, with code number shown within the cell where its value would be displayed:

Metropolitan		Nonmetropolitan	
0	1	4	5
2		6	7
3		8	9

That organization is employed in table 8 and in subsequent tables. Table 8 reinforces the impression of a considerable narrowing of metro-nonmetro income differences through QOL deflation. Thus, the ratio of lowest to highest per capita income (income for Code 8 relative to that for Code 2, both before and after deflation) is 0.6 before and 0.8 after deflation. Even after deflation, however, per capita incomes for all of the nonmetro cases remain below the U.S. average, and below each of the metro cases.

III. Poverty

The Literature

Many observers recognize that poverty measures could benefit from cost-of-living adjustments. Often, however, the task is viewed as so difficult as to verge on the impossible.[33] Yet there are those (perhaps incurable optimists) who feel we must get on with the job. For example, Joseph Dukert notes that the official poverty index sets a national income standard, regardless of local variations in living costs. That omission is a major factor explaining why "(1) Some of the people below the present 'poverty line' are not among the 'truly needy.' (2) Some of those above that line are. (3) The truly needy--and the nation as a whole--would be better off if they could be identified."[34]

There have been some attempts at adjustment of poverty data using crude approximations for geographic cost-of-living differentials. Fendler and Orshansky note an attempt which incorporated metro-nonmetro and regional differentials for 1978. The adjustments resulted in a slight drop in the number of persons below the poverty line, but the primary impact was to increase the number of poor in the North and reduce the number in the South.[35] (Specifically, the Northern increase was 0.7 million and the Southern decrease was 1.4 million, relative to an initial total of 24.7 million persons in poverty.)

Hoppe applied a housing value index as a proxy for a cost-of-living index to simulate the effects on eligibility and benefits under a proposed income maintenance program which would replace current programs (food stamps, AFDC, etc.). Comparisons were made before and after deflation.[36] Since the index for the South was below that for the North, and that for nonmetro areas was below that for metro areas, deflation caused a shift of eligibility and benefits from the former to the latter, in each case. Metropolitan versus nonmetropolitan money benefits per family, before and after deflations, were estimated as follows:

	Metro	Nonmetro	Nonmetro - by metro
Before	$3,450	$3,110	.901
After	3,690	2,550	.691

Hoppe concludes that approximately 50 percent of U.S. poor families would experience decreased benefits because of cost-of-living adjustments. He adds, "people living in nonmetropolitan or southern metropolitan areas may prefer uniform benefits despite the equity of cost-of-living adjustment. Uniform benefits would provide greater real purchasing power to areas with low cost of living indexes."[37] (Since people usually prefer more to less, his argument has its obvious side. But, of course, it points to a source of real resistance to cost-of-living adjustments.)

The present study applied its QOL index to examine effects on three poverty measures, including (1) counties with low per capita incomes, (2) the frequency of low incomes within family income distributions from the 1980 Census of Population, and (3) the levels of income maintenance transfers. For ease of exposition, the "before deflation" case will be termed a "nominal" value, and the "after deflation" case will be termed a "real" value.

The Low-Income Counties

Employing 1973 as base year, and considering the 100 poorest counties, 97 were nonmetropolitan when ranking was performed using nominal per capita income, and 90 were nonmetropolitan when ranking used real per capita income.[38] In contrast, of all 3,140 U.S. counties, 79 percent were nonmetropolitan in that period. Once again, then, deflation yields some diminution of the metro-nonmetro gap, but it is a modest diminution.

The five poorest counties were as follows, under the two sets of measurements, listed in reverse order of income, so the poorest appears first:

Nominal Per Capita Income	Real Per Capita Income
1. Issaquena, Mississippi	1. Shannon, South Dakota
2. Owsley, Kentucky	2. Issaquena, Mississippi
3. Elliot, Kentucky	3. Mora, New Mexico
4. Maverick, Texas	4. Conejos, Colorado
5. McCreary, Kentucky	5. Owsley, Kentucky

All of these counties have Brown-Hines codes of 9, save for Maverick and Shannon, each with a code of 7. The nonwhite population was 57 percent of

the total for Issaquena, and 88 percent of the total for Shannon. Deflation does cause a greater representation of western counties and fewer southern. This shift remains evident when we compare the 50 counties of lowest per capita income under the two headings, in terms of their location by state:

	Number of Counties	
	Nominal Per Capita Income	Real Per Capita Income
North Central		
Illinois	1	1
Minnesota	0	1
Missouri	4	8
South Dakota	1	1
South		
Arkansas	1	1
Georgia	2	2
Kentucky	19	14
Louisiana	1	1
Mississippi	2	2
Oklahoma	4	4
Tennessee	4	2
Texas	6	4
West Virginia	2	1
West		
Colorado	1	2
New Mexico	1	5
Utah	1	1
Total	50	50

There is a fair amount of overlap in these lists. The large number of Kentucky counties appearing in both lists is somewhat surprising, implying that Kentucky's low-income problem is pronounced, relative to all other states, however we measure income.

If we consider the lowest income decile, that is the 314 counties with lowest per capita incomes, relative to all 3,140 counties, we find considerable overlap between the nominal and real, with 235 counties in common. The distribution of nominal cases that fell in the lowest real decile was as follows:

Nominal Decile	Number of Counties
1	235
2	59
3	11
4	3
5	4
6	2

Hence, some marked differences between the two sets do occur.

Of the 314 poorest counties in 1973 (those in the lowest per capita income decile), 11 had a spurt in real income great enough so they exceeded the U.S. median income level in 1981; only five counties exhibited such moveme t under the nominal income measures. All five of the latter were energy-producing counties, with four in Texas, and one in Louisiana. Of the 11 high growth cases using the real income measure, the distribution by state was Texas: 8, Louisiana: 2, and Colorado: 1. Nine of the 11 were energy producers, and a tenth, Mineral County, Colorado, appropriately (given its name) was a producer of copper, silver, zinc, lead, and cadmium.

Low-Income Families in 1979 Income Distributions

Income distributions for 1979 appearing in the 1980 Census of Population were utilized to trace out the effects of QOL deflation on the number of low-income families; applying the scale factors of the QOL index the distributions of family income for each of five ethnic groups, before and after deflation, were obtained.[39] The ethnic groups were Whites, Blacks, American Indians, Asian and Pacific Islanders, and Hispanics. In transforming the "before" distribution, the simplifying assumption was made that a uniform distribution held for persons within each cell of the overall distribution. In practice, this meant that if 20 percent of an initial class interval were shifted to another class interval, then 20 percent of the frequency within the class interval was also shifted. To analyze the effect of deflation on the number of low-income families, a low-income dividing line of $7,500 was established. This point was selected because the number of families in the United States initially below that level corresponded well to the number of families below the official poverty threshold.[40]

Table 9 compares the before and after results for each of the ethnic groups for the United States as a whole, and for metro versus nonmetro location. In considering the results, recall that the base for the comparison is a population of 10,000 to 25,000 in a contiguous nonmetro area averaged over all regions. Hence, it should not be surprising that the metro fraction of all families with income under $7,500 is greater in real terms than in nominal terms for all cases. Similarly, the nonmetro fraction increases for American Indians and for the Asian and Pacific Islander group; it remains essentially unchanged for Whites and Hispanics; and it decreases for Blacks.

In the nominal income cases, the nonmetro fraction with low incomes is always considerably larger than the corresponding metro fraction. After deflation, the two fractions become much closer in size, though the nonmetro fraction remains larger in all cases save for Hispanics, where the real income fraction is a bit larger in the metro than in the nonmetro case.

These results parallel those presented earlier: income deflation causes a reduction of the metro-nonmetro income gap, but generally does not close it.

Table 10 extends the comparisons to contiguous and noncontiguous nonmetro areas. Little change occurs in the fraction below $7,500 for real versus nominal measures in the case of Whites and Hispanics; both contiguous and noncontiguous fractions decrease for Blacks and increase for American Indians and for Asians and Pacific Islanders. The noncontiguous fraction is greater than the contiguous in all cases, both nominal and real, save for the Asian and Pacific Islanders group, where the reverse relation holds. However, the difference between the contiguous and noncontiguous fractions tends to narrow when we move from nominal to real income measures. This is particularly pronounced for the Black families. Blacks generally have the lowest incomes in both sets of comparisons represented by tables 9 and 10. However, real differences between Blacks and American Indians are considerably narrower than nominal differences. In particular, in the real income enumeration in table 10, the largest nonmetro fractions (the most families with low incomes) are as follows:

Table 9. Low-Income Families (with Income Below $7,500) As Fraction of All Families, 1979, Metro Versus Nonmetro

Ethnic Group	Fraction of All Families Employing Money Income	Fraction of All Families Employing Income Deflated by QOL Index	Total Families Reported in Thousands
White			
All	0.1111	0.1319	50,452.8
Metro	0.0933	0.1227	35,394.7
Nonmetro	0.1530	0.1534	15,058.1
Black			
All	0.3025	0.3372	6,019.7
Metro	0.2854	0.3349	4,884.9
Nonmetro	0.3762	0.3470	1,134.8
American Indian			
All	0.2607	0.2938	324.8
Metro	0.2171	0.2660	174.2
Nonmetro	0.3111	0.3260	150.7
Asian & Pacific Isl.			
All	0.1245	0.1644	812.8
Metro	0.1208	0.1626	742.4
Nonmetro	0.1632	0.1829	70.4
Hispanic			
All	0.2333	0.2843	3,272.3
Metro	0.2286	0.2872	2,818.8
Nonmetro	0.2625	0.2662	453.5

Table 10. Low Income Families (with Income Below $7,500) As Fraction of All Families, 1979, Nonmetropolitan Contiguous Versus Noncontiguous

Ethnic Group	Fraction of All Families Employing Money Income	Fraction of All Families Employing Income Deflation by QOL Index	Total Families Reported in Thousands
Whites			
Contiguous	0.1415	0.1458	8,400.1
Noncontiguous	0.1674	0.1631	6,657.9
Blacks			
Contiguous	0.3616	0.3397	635.2
Noncontiguous	0.3948	0.3563	499.6
American Indians			
Contiguous	0.2948	0.3030	70.8
Noncontiguous	0.3256	0.3464	79.9
Asians & Pacific Isl.			
Contiguous	0.2014	0.2182	25.4
Noncontiguous	0.1417	0.1630	45.0
Hispanics			
Contiguous	0.2498	0.2625	262.2
Noncontiguous	0.2793	0.2715	191.3

Blacks - noncontiguous	.356
American Indians - noncontiguous	.346
Blacks - contiguous	.340
American Indians - contiguous	.303

Income Maintenance Transfers

Table 11 compares income maintenance transfers before and after deflation by the QOL index, for the United States as a whole, for metro versus nonmetro areas, and for the Brown-Hines codes.[41] Income maintenance transfers include both federal and state and local funds under the Supplemental Security Income Program, AFDC, General Assistance, Food Stamps, and all other programs. (The latter does not include Medicaid.) Before deflation, nominal transfers per capita are higher in metro than in nonmetro areas by approximately 20 percent (160.4/136.4 = 1.18). After deflation, the relationship reverses, with real nonmetro transfers per capita about 5 percent above the corresponding metro transfers (138.2/132.6 = 1.04).

At a finer level of geographic detail, the real value of income transfers per capita decreases for the first six Brown-Hines codes (0 through 5) and increases for the remaining cases (6 through 9). Relative to the U.S. average, class 0 and classes 6 through 9 are above average in the real income comparisons. Class 0 has the highest level, but classes 8 and 9 are not very far behind, in real terms, representing a considerable shift from the nominal values.

In summary, though our procedures involve first approximations, and though changes observed in poverty levels and transfer payments are not extreme, nevertheless some noteworthy changes do emerge, and it is hoped, present a more accurate picture of the poverty situation than is currently available using undeflated money measures.

IV. Resources

A number of likely interactions and interrelations between income and natural resources merit detailed empirical investigation, as documented in the papers for this workshop. Such investigation is planned as a second phase of this project; to date, some preliminary pilot studies have been

Table 11. Comparisons of Income Maintenance Transfers in 1981 for Metro and Non Metro Areas

	Income Maintenance Transfers Per Capita[a] In Dollars		Deflated Income Maintenance Transfers Per Capita	
U.S. Average	153.8		134.1	
All Metro	160.4		132.6	
All Nonmetro	136.4		138.2	
Brown-Hines Code				
0,1	232.5	82.9	181.6	66.4
2	134.7		119.6	
3	125.9		116.5	
4,5	127.5	134.9	120.8	133.8
6,7	131.3	142.6	134.8	149.8
8,9	154.4	155.5	164.3	163.4
	As Percent of U.S. Average			
U.S.	100.0		100.0	
All Metro	104.3		98.9	
All Nonmetro	88.7		103.1	
Brown-Hines Code				
0,1	151.1	53.9	135.4	49.5
2	87.6		89.2	
3	81.9		86.9	
4,5	82.9	87.7	90.1	99.8
6,7	96.3	92.7	100.5	117.7
8,9	100.4	101.1	122.5	121.8

[a]Transfers include supplemental security income, AFDC, General Assistance, Food Stamps, and All Other.

carried out on that work and are reported in this section. Those pilot studies include (1) an investigation of per capita income related to coal production in Kentucky; (2) an examination of patterns of irrigated land use in agriculture; and (3) an examination of off-farm work and government payments in agriculture.

Kentucky Coal and Per Capita Income

Table 12 presents a comparison of nominal and real per capita income levels for groups of Kentucky counties in 1970 and 1980. The counties are grouped in terms of coal production and location, since the eastern and western coal fields are at the opposite ends of the state, with non-coal-producing counties located in between. Low income clearly is much more of a problem in eastern than in western Kentucky, and the use of real rather than nominal income measures does not much affect this conclusion.

As might be expected given higher energy prices since 1973, incomes in coal-producing counties grew more rapidly from 1970 to 1980 than did per capita income in non-coal-producing areas. Western Kentucky coal counties' per capita income moved from somewhat below to somewhat above that of the nonproducers, and the eastern Kentucky coal counties' per capita income moved closer to that of the nonproducers, though a considerable gap remained.

The relation of per capita income to coal production was further examined by means of regression equations in which coal production in tons per capita was used to explain per capita income, with a distinction between eastern and western coal built into the equations.[42] It turned out that the contribution of an additional unit of coal production always yielded somewhat more real than nominal income in the coal-producing counties. In the eastern Kentucky counties, coal production in tons per capita was as follows for three years of interest:

1970	1975	1980
0.0632	0.0731	0.0843

The estimated contribution of an additional ton per capita to eastern Kentucky per capita income was as follows, for nominal versus real income, in terms of percentage increases in per capita income:

Table 12. Income Comparisons for Kentucky Counties, Coal Versus Noncoal Producers

Type of County	Money Income Per Capita in 1981 Dollars		Per Capita Income Deflated by QOL Index		1980/1970
	1970	1980	1970	1980	
			Dollars		
Non-coal-producing[a]	6,507	7,414	7,042	8,014	1.14
Eastern coal[a]	4,671	6,027	5,193	6,687	1.29
Western coal[a]	6,303	7,834	6,869	8,549	1.25
All counties	5,813	7,026	6,415	7,663	1.20
Coal producers as percent of non-coal-producing counties			Percent		
Eastern coal	71.8	81.3	73.7	83.4	1.13
Western coal	96.9	105.7	97.5	106.7	1.09

[a]Of a total of 120 counties in Kentucky, 63 are non-coal-producing, 39 are in the eastern coal region, and 18 are in the western coal region. Corresponding 1980 populations for those regions, in thousands, were: non-coal region: 2,210; eastern coal region: 930; western coal region: 510.

	1970	1975	1980
Nominal	-2.09	19.61	24.09
Real	8.34	24.36	27.20

Thus, in 1970, if coal production were to increase by one ton per capita, money income per capita is estimated as being reduced by roughly 2 percent, while real income would increase by somewhat over 8 percent. The difference likely reflects a statistical distortion imposed by the use of nominal rather than real income in the regression equation, plus the direct effect of converting nominal to real income in places of small population size. The differences between nominal and real effects in the later years are not so pronounced, perhaps because of the boom in energy production post-1973. Nevertheless, in 1975, real income increased by 24 percent more than nominal income per additional unit of coal produced (24.36/19.61 = 1.24).

Results for western coal counties paralled the eastern. Thus, western production in tons per capita for the years of interest was:

1970	1975	1980
0.0403	0.0461	0.0493

The percentage increase in per capita income for an increase of one ton of coal per capita was as follows, for nominal versus real income:

	1970	1975	1980
Nominal	18.75	34.42	69.40
Real	20.50	36.39	73.31

The increase in real income always exceeds the increase in nominal income, though the difference between the two is less pronounced than in the eastern coal case.

Of course, in practice the amount of increase in coal production, in terms of tons per capita, is likely to be on the order of 0.01 tons, given the production data shown above. But note also that the increase in per capita income is at the county level, and holds for all persons, including those in non-coal mining families.

An interesting and likely important implication here is that resource development yields higher returns when measured in real rather than in nominal terms. In fact, the results for the nominal case in 1970 suggest that expansion of coal production in eastern Kentucky will reduce incomes. In retrospect, the contrast may not seem too surprising, since most resource extraction activities occur in places of small size, yet the results do not seem obvious before the fact.

Some additional analysis was carried out by combining annual data on coal production and per capita income with coal prices for eastern and for western Kentucky to obtain a pooled sample over the years 1970 through 1981. All dollar values were deflated to 1981 by the Consumer Price Index and the per capita income values were also deflated by the QOL index. Both coal price and production were statistically significant in explaining per capita income, and it turned out that an increase in production had a much more pronounced effect on income after 1973 than before that year, even though there had been an accounting for price. Perhaps this involved multiplier effects of increases in incomes in coal regions which generated increases in economic activity throughout the state. Price had a strong relation to income, and it was estimated that an increase of $10 a ton in coal prices would lead to an 8 percent increase in real income per capita. Since coal prices increased by $15 per ton (in 1981 prices) from 1970 to 1981, a 12 percent increase in per capita income is thus explained. Of course, energy prices have been subject to downward pressure in the last few years, with corresponding negative impacts on Kentucky income.

Irrigated Acreage

Table 13 presents data on irrigated acreage as a fraction of all acreage in crops for U.S. and western region agriculture, as of 1974.[43] The upper part of the table exhibits the fraction by Brown-Hines code, and it is manifest there is a general decrease in the fraction as we move from places of larger to those of smaller settlement size. The explanation may be as simple as the greater availability with increasing size of settlement of water systems furnishing municipal-industrial water supplies. But some implications of this explanation (if indeed it is the explanation) may be important. This suggests that complementarity rather than conflict may generally hold for agricultural versus urban use of water. Again, the

Table 13. Irrigated Acreage as a Fraction of Acreage in Crops by Income Deciles and Brown-Hines Codes, 1974

Classification	Irrigated Acreage as Fraction of All Acreage in Crops			
	United States		West Region	
Brown-Hines Codes				
0,1	0.256	0.034	0.525	0.142
2	0.153		0.728	
3	0.107		0.395	
4,5	0.154	0.135	0.478	0.501
6,7	0.057	0.103	0.332	0.336
8,9	0.059	0.074	0.155	0.226

Classification	United States		West Region	
	Nominal Deciles	"Real" Deciles	Nominal Deciles	"Real" Deciles
Per Capita Income Deciles				
1: Lowest	0.058	0.090	0.421	0.516
02	0.056	0.063	0.538	0.646
3	0.052	0.080	0.524	0.531
4	0.083	0.105	0.610	0.438
5	0.098	0.158	0.521	0.585
6	0.088	0.074	0.377	0.355
7	0.129	0.087	0.448	0.397
8	0.129	0.083	0.471	0.507
9	0.082	0.079	0.244	0.234
10: Highest	0.094	0.106	0.132	0.124

result may lend support to the T.W. Schultz industrial-urban development hypothesis.

Table 13 also compares the irrigated acreage fraction for income deciles, using both nominal and real per capita income, that is, for groups of 314 counties each, arrayed from lowest to highest per capita income, as of 1973. Note that per capita income refers to county averages, covering all persons in the county and all sources of income, rather than to farm income per farm.

There are some differences in pattern for nominal versus real deciles, but they do not seem profound. For the United States, the fraction of land irrigated does not seem particularly related to income, while for the West there appears something of an inverse relationship. Several hypotheses can be considered in exploring this result. Irrigation projects may tend to be located in low-income counties as an explicit expression of policy aimed at raising farm incomes. Another possibility is that irrigation development in the West is associated with high farm incomes but low county incomes; perhaps large farms (even to the extent of "factories in the field") tend to be heavily dependent on irrigation and low-income farm labor, affecting the level of per capita incomes. No doubt one implication of these speculations is that caution must always be exercised in examining income-resource relationships.

Off-Farm Income

Tables 14 and 15 present some additional information derived from the 1974 Census of Agriculture, again using both the Brown-Hines codes and income deciles. Table 14 exhibits estimated annual days of work off farm per farm operator. The Brown-Hines results show a clear pattern of decreasing days of work with decreasing size of settlement. This can be interpreted as either a demand- or supply-of-labor effect, or as some combination of both. The demand-for-labor effect would involve a greater availability of off-farm work opportunities, the larger the size of settlement, again conforming to the Schultz hypothesis. The supply-of-labor effect would involve a greater percentage of farm operators looking for off-farm work, that is, more likely to need off-farm work because farming is not a full-time occupation or because income derived from farming is limited. The decile results appear to show a decided supply effect, for

Table 14. Estimated Average Days Work Off Farm Per Farm Operator, 1974, By Brown-Hines Code and Decile

Brown-Hines Classification			Income Decile Classification		
				Days Work Off Farm	
Codes	Days Work Off Farm		Decile	Nominal Decile	Real Decile
			1: Lowest	111.4	112.0
0,1	118.6	115.9	2	110.8	110.3
2	114.4		3	111.7	110.5
3	112.9		4	108.1	109.4
			5	105.1	104.8
4,5	104.7	95.9	6	105.1	106.1
6,7	101.6	87.6	7	97.9	102.8
8,9	99.1	77.8	8	92.2	89.0
			9	76.7	72.3
			10: Highest	52.7	50.9
U.S. Average	97.1				

Source: Computer data tape of 1974 Census of Agriculture.

Table 15. Average Income Per Farm from Government Programs, 1974, By Brown-Hines Code and Decile (Dollars per Farm)

Brown-Hines Classification			Income Decile Classification		
	Govt. Program			Govt. Program Income	
Codes	Income		Decile	Nominal Decile	Real Decile
0,1	31.5	62.4			
2	87.6		1: Lowest	61.9	71.6
3	99.1		2	73.6	76.0
			3	80.5	88.1
4,5	95.8	184.4	4	88.9	84.4
6,7	89.8	148.6	5	90.5	96.6
8,9	117.4	194.1	6	109.2	82.9
			7	123.0	100.6
U.S.			8	120.7	115.3
Average	121.4		9	167.5	169.6
			10: Highest	313.2	334.5
			U.S. Avg.	121.4	119.6

Source: Computer data tape of 1974 Census of Agriculture.

both nominal and real cases. The lower the income, the greater the days worked off farm. Given the considerable spread in days of off-farm work between lowest and highest levels shown in table 14, and the corresponding impact on income, the relationship appears to merit more detailed study.

Table 15 presents data on government program payments per farm in 1974. Commodity programs should account for the bulk of the payments, probably explaining the results for the Brown-Hines codes. In those cases, the noncontiguous, nonmetro counties receive higher payments per farm than do the contiguous and metro counties, probably because the production of major supported commodities is centered in the noncontiguous counties.

For both nominal and real deciles, there seems a clear pattern of increasing payments with increasing decile, here suggesting that per farm income is actually well correlated with county per capita income for the United States, and that the higher the income, the higher the government support payments. But that should be no great surprise, since commodity payments are geared to production.

In retrospect, then, a number of resource-income relationships have emerged within our limited pilot studies, implying good potential for further work.

V. Conclusion

This concluding section considers some critiques of wage differential analysis and of quality-of-life deflation and attempts to turn the points at issue to advantage by considering how they can be applied in future research. The section also considers some of the key implications of our approach and results for analysis and policy.

Critiques

A common critical argument is that what appear to be size-of-place or regional differentials are really ascribable to unionization. This argument is open to question, for even though some unions do appear to be successful in raising wages for their members,[44] and the location of strong unions may well be negatively correlated with the South and positively correlated with size of settlement, that does not necessarily mean that all wage rates generally will move in tandem with union wage scales. It is

plausible that strong unions limit entry to their occupations, and thus force more workers into other occupations, thus driving down wages there. In support of this point, Lawrence M. Kahn has developed some evidence showing that big city unions raise their own members' wages but tend to lower those of nonunion members.[45] Further, the North-South union effect may be open to question, for Barry Moriarty examined North-South manufacturing wage differentials and found that the percentage of unionized workers was not correlated with wage rates.[46]

In our work with teachers' salaries, we had a large sample for Illinois which included information on whether a union agreement was in force for each school district. The information also identified the union as one among the National Education Association (NEA), the American Federation of Teachers (AFT), or an independent union. When we related Illinois teachers' salaries by size of place, a U-shaped relation emerged whether or not unionization was included, that is, wage rates first fell and then increased as size of place increased. However, the addition of unionization as an explanatory variable strengthened the size-of-place effect, both in terms of a more well-defined association and in terms of statistical power.[47] Hence, rather than finding that we had ascribed some union effect to size of place, we found that explicit recognition of unionization strengthened the size-of-place effect. Incidentally, the AFT was somewhat more effective than the NEA in raising wages, and both were more effective than independent unions. (Explicit evidence on the Illinois relationships is presented in the appendix.) The upshot of our experience is that the introduction of unionization as a variable is not only recommended as a test of our central hypothesis, but as a likely source of improvement of fitted relationships.

William Alonso has grave reservations about the wage differential approach, doubting that "the sum of real money income and psychic income is equal everywhere" since it is a "plain fact" that many poor places are not nice, and that many nice places are not poor.[48] But Alonso appears to identify cost of living (a price measure) with level of living (a quantity measure) which seems illegitimate, as well as confusing. The wage differential argument is that the same work will receive exactly the same real returns at equilibrium; it does not deny the existence of poverty, since people perform different kinds of work and own different amounts of

resources; nor does it deny that the distribution of rich and poor can vary between places. Alonso's concerns, expressed soberly, involve equilibrium. There appear to be two aspects. First, the use of wage differentials in measurement attains full precision at equilibrium; since the real world can best be described as always on the way to equilibrium, rather than having arrived, our quality-of-life estimates are bound to be not quite precise. But the general stability of results over extended time periods and diverse occupations (as shown, for example, in tables 2-5, above) suggests that real world disequilibrium is generally not a serious problem.

A second aspect is the possibility that with enough people in a locale having a low level of living, the cost of living itself will be reduced. Some questions that arise are (1) what is the quality of work performed by those with the low level of living? If they receive low wages, those may not be out of line with what they produce. (2) Does the putative cost-of-living effect correlate with size of place? If there are pockets of poverty at various locations, possible impacts on cost of living would have no systematic effects on relative differences. (3) Can those with a low level of living receive more for their work elsewhere? If so, why don't they move? Is there "disequilibrium" by choice? Although Alonso's concerns may be misplaced or exaggerated, they probably deserve serious study, both because they are likely to be widely held,[49] and because they may hold in some special circumstances.

Key Implications

The analysis of wage differentials is useful in improving economic measurement, as we have attempted to demonstrate, but it seems even more important as an aid to understanding and interpreting a variety of economic phenomena. Some important examples are as follows:

1. Nonmetro areas have recently grown at a faster rate than metro areas, and the South has grown at a faster rate than the Northeast and North Central regions.[50] Thus, there has been a movement from high to low wage areas, a movement seen as remarkable by some. For example, that seems the position of Larry Long, who notes that "the South, a low-income region traditionally exporting low-income persons...[has had] a small net gain of persons below the poverty level."[51] But it seems reasonable to infer that there is migra-

tion out of New York City not because its wage rates are high, but because they are not high enough, in real terms. And people are moving into the South and nonmetro areas not because money wage rates there are low, but because real wage rates there are high, relative to the alternatives.

2. The lower quality of life and higher rents in large places (for which compensatory payments are necessary) has been called the "urban disamenity." The work of this paper extends the concept to smaller places as well, and consequently yields the implication that a better name might well be the "urban-rural disamenity" or the "non-optimal size disamenity." The magnitude of that disamenity was estimated here as 13 percent of income, that is, 13 percent of income compensates people for the higher rents and lower disamenities that come with living at places of other than 10,000 to 25,000 population. (See table 7 for explicit income comparisons.)
3. The redistribution of population from metro to nonmetro places (the rural turnaround) and from frostbelt to sunbelt can imply that measured increases in productivity in money terms somewhat understate real increases in productivity.
4. Accounting for quality-of-life differences implies the possibility of better identification of the truly needy and better targeting of income maintenance payments to those in need.
5. Because there has been a considerable shift of Blacks from small places in the South to large places in the North, real income gains of Blacks may be exaggerated.
6. The existence of cost-of-living differentials implies the possibility of a form of arbitrage, that is, taking advantage of price differences for the same commodity in two different markets. In particular, people who have earned a retirement income in a large Northern metropolitan area can make that retirement income go further by retiring to a small place in the South.
7. Because resource extraction activities tend to be located in nonmetro areas, real returns to those activities will tend to be understated, relative to returns in other activities. Hence, evaluation of the potential for resource development is likely to err on the side of pessimism.

8. An extension of item 7 is that investment decision rules may bear modifying if the source of investment funds is a different locale than the point of investment and of expected returns. To clarify, say the U.S. government is considering investment of public funds whose source can be viewed as the nation as a whole. The usual investment criterion is that for a marginal dollar of expenditures, marginal returns ought to be equal in all alternative forms of investment, and equal to one dollar if capital is not rationed. If investments are lumpy, then for a given increment of investment, we ought to select the alternative yielding the highest return. But differences between nominal and real returns can cause reversals of choices. For example, say a million dollar investment of public funds will yield 1.2 million dollars of monetary benefits in New York City or 1.1 million dollars of monetary benefits in rural Mississippi, with both sets of benefits consumed at their point of generation. The conventional choice would be New York over Mississippi, but the unconventional and, we believe, the correct choice would appear to be the other way around. Recent complaints that northern, highly urbanized states do not receive their fair share of federal expenditures may well be met by this argument.

In sum, improved accounting for QOL differences can be of help not only in reducing or eliminating distortions in measuring incomes, but in furnishing insight on a variety of problems. It is our hypothesis and hope that a major area of application will be in the establishment of important connections among resources, development, and income. The evidence so far lends support to the hypothesis and feeds that hope. Some elaboration of that point concludes this paper.

Resource and Income Connections

Resources and income are related in a variety of ways, and future work can be directed to cataloging and analyzing this variety. Thus, consider a cross-classification of high and low levels of each variable.

1. High resource endowment, high income: The owners of rich agricultural land, or of a producing oil well, or of land at the intersection of major transportation arteries, will usually do

quite well financially. Writ large, those factors enter into the economic success of such places as Iowa, Houston, and Chicago.

2. Low endowment, low income: In a number of locations, resources have been depleted--mines have petered out, wells have gone dry, fisheries have been exhausted, and timber has been cut without replacement. In places heavily dependent on such resource extraction, lags in adjustment often occur and are a source of low incomes.

   Again, some groups have limited resources. Thus, nonwhite farm operators in 1974 had an average farm size that was only a third that of whites.[52] The relevant policy question here is whether an infusion of additional acreage in itself would be enough to increase incomes accordingly, or whether both more acreage and additional entrepreneurial capacity are needed. (This is a point made by Clawson in his paper for this conference.) It has been argued that the Agricultural Extension Service has tended to neglect low-income nonwhite farm operators, which would fit the hypothesis that additional entrepreneurial capacity is needed, at least in the form of access to and use of better information.

3. Low endowment, high income: This combination can occur in a harsh environment which drives out all but the most able of economic actors. Those survivors of what is an evolutionary process will then be observed to have above average incomes. Norman and Castle hypothesized this situation in attempting to explain differences in farm income in Kansas and Oregon, with results that were generally consistent with the hypothesis.[53] As climate became more harsh, large-scale, specialized, commercial agriculture became the rule; the successful operators were those who could operate in situations of high risk, with high returns to entrepreneurial capacity, including the ability to adopt new technology. In contrast, it appeared that operators prefering lower risk and steadier, if lower, average income tended to gravitate to areas of better climate, where subsistence production, as well as commercial agricultural production, was much more likely to be viable, and in fact, was much more common.

4. High endowment, low income: In addition to the low-risk situation pointed to by Norman and Castle, several other cases can be subsumed under this heading. They include situations where a rich resource base is exploited by large numbers of low-skilled laborers, because that is the most economic organization of resources. Key policy questions here include the following: what, if anything, is being done to transform low-skilled to high-skilled labor? Are there institutional constraints on such transformations? What are worker preferences for such transformations? A second group of cases involves situations where rich resources are not properly exploited because of lack of knowledge, or lack of management capability, or because of institutional constraints. In economic terms, income opportunities are being missed either because output is not pushed to the production frontier, or because there is lack of proper response to prices. The economic situation of many Indian tribes appears to fit under this heading; considerable potential exists for water or minerals development, but has not been properly exploited.

Distinguishing and analyzing these and related cases should be helped by the improved income measures developed in this paper.

Appendix

This appendix presents some additional material that should be of interest to the technically oriented reader. Appendix table 1 presents regression results for sixteen of our samples used in relating wage rates to population size. Only statistically significant results for the coefficient of log population and its square are shown, that is, we employed the equation form: $W = a + b(LPOP) + c(LPOP)^2 + dD$, where W is wages; a, b, c, and d are coefficients, with d a vector; D is a corresponding vector of dummy variables; LPOP is the log of population, and $(LPOP)^2$ is the square of that log, i.e., the log is first taken and then squared. The formulation allows a minimum or maximum wage to occur. Appendix table 1 presents the estimated coefficients for b and c, when either or both are significant. A U-shaped relation emerges when b is negative and c is positive; that occurred in six cases of those shown.

Appendix table 2 presents the Illinois teacher salary regression results, in which unionization, population size, and location characteristics are included. Unionization was accounted for by dummy variables for National Education Association (NEA), American Federation of Teachers (AFT), or other union contract, respectively. Population size was measured by our standard variables, the log of population size, and its square. Location characteristics were covered by dummy variables for nonmetropolitan contiguous and noncontiguous counties, with a metropolitan area dummy variable the excluded case to avoid exact colinearity.

Appendix table 3 presents selected regression coefficients and corresponding t ratios for the Kentucky coal regression using real per capita income as the dependent variable and a pooled sample covering observations on counties over the period 1970-80. The independent variables included coal production in tons per capita, and the western Kentucky increment to that variable, obtained by multiplying a dummy variable for western Kentucky coal counties times the coal production variable. The independent variables also included the price of coal deflated by the Consumer Price Index, dummy variables for eastern and western counties, respectively, and the percentage of coal mined underground, as opposed to stripmining. Coefficients have been standardized to show their contribution to per capita income in percentage terms. In developing the inde-

Appendix Table 1. Selected Regression Results for 16 Samples Relating Wage Rates to Population Size and Other Variables

	Coefficients[a]			t ratios			
	Intercept	LPOP	$(LPOP)^2$	LPOP	$(LPOP)^2$	R^2	No. of Observations
1970 Census of Population							
Male Occupations							
Laborers	112.77	-6.58	3.26	3.09	5.60	.32	3,126
Farm operators	136.30	-22.40	5.30	6.38	5.53	.12	3,087
Farm laborers	132.84	-21.91	6.22	6.60	6.81	.15	3,092
Professional	80.78	14.98	-	25.31	-	.43	3,134
Craftsmen	90.64	8.05	0.89	6.14	2.46	.49	3,135
Operatives	99.77	6.14	-	7.70	-	.34	3,129
Female Occupations							
Clerks	89.33	6.30	1.24	4.70	3.33	.28	3,135
Operatives	73.85	26.70	-3.30	10.68	4.92	.22	3,084
Teacher Salary Schedules							
21 State Sample 1981-2							
Bachelors Min.	85.66	-3.00	1.15	3.59	7.02	.48	3,674
Masters Min.	82.60	-1.97	1.08	2.01	5.67	.43	3,645
1975-76							
Bachelors Min.	92.26	-2.39	1.22	3.37	8.66	.38	3,585
Masters Min.	81.00	4.83	-	7.38	-	.09	3,551
ERS Sample 1979-80							
Bachelors Min.	86.34	4.28	-	8.67	-	.27	1,015
Municipal Employee Salary Schedules, 1979							
Police Min.	68.64	10.56	-	12.96	-	.58	1,156
Firemen Min.	69.34	11.08	-	17.16	-	.62	1,142
Sanit. Works. Min.	79.35	10.25	-	7.25	-	.53	811

[a]Only statistically significant coefficients are shown. Salaries measured as percentage of average salary, with average set at 100.

- Indicates not significant.

Sources: 1970 Population Census data on computer tape of 1970 Census fourth count population employment count extract file. Teacher salaries--21 state sample from data in 21 individual state reports (Ala., Ark., Conn., D.C., Fla., Ida., Ill., Ind., Ky., Me., Md., Minn., N.H., N.J., N.M., Ore., S.C., Tenn., Utah, Va., Wyo.). ERS sample from data in Educational Research Service, Inc. data in ERS Report, 1980, Arlington, Va. Municipal employee data covering policemen, firemen, and sanitation workers derived from data on International City Managers Assn. computer tape. Min. refers to minimum salary, typically an occupation's starting salary.

Appendix Table 2. Illinois Teachers Salary Schedule, 1981-2, Related to Unionization, Size of Place, and Area

Variable	Coefficients in Regression Equation[a]			
	Bachelors Degree		Masters Degree	
	Minimum	Maximum	Minimum	Maximum
Constant	101.40*	95.59*	94.21*	97.98*
Union				
NEA	3.30*	8.03*	5.14*	10.66*
AFT	4.44*	9.97*	4.18	9.23*
Other	2.03	4.66	3.06	8.60
LPOP	-4.91*	-3.98	-3.25	-12.24*
$(LPOP)^2$	1.30*	1.44*	0.98*	3.81*
Contiguous Nonmetro	-0.95	-1.83	-1.22	-0.78
Noncontiguous Nonmetro	-0.08	-0.14	-1.03	0.91
R^2	.19	.24	.21	.45
Number of Observations	964	964	964	964

[a]Salaries measured as percentage of average salary, with average set at 100.

*Statistically significant at 5% level.

Source: Derived from data in Illinois State Board of Education, Illinois Teacher Salary Schedule and Contract Provision Study 1981/83, Springfield, Illinois, 1982.

Appendix Table 3. Selected Regression Coefficients In Equation Explaining Kentucky Per Capita Income on the Basis of Coal Production Characteristics, Using Pooled Sample

Variable	Coefficient[a]	t ratio
Intercept (mkt. size 5)[b]	80.81	-
Coal production in tons per capita	22.08	3.69
Western increment to coal production in tons per capita[c]	-2.30	0.28
Price of coal in dollars per ton	0.81	16.19
Percent underground production	0.06	2.96
Eastern Kentucky	-30.08	24.90
Western Kentucky	6.76	4.18
R^2	0.52	-
Number of observations	1,319	-

[a]Percent contribution to real per capita income, with average county per capita income equal 100.

[b]Market size 5 corresponds to a population of 10,000 to 25,000.

[c]Interaction term consisting of coal production times Western Kentucky dummy variable.

pendent variables, the price of coal was not deflated by size of place, under the interpretation that coal was shipped out of the area, and did not enter directly into measuring local income. In any event, major changes in coal prices that affected income occurred between years in the period under investigation. The equation also employed the market area variables, which had an effect typically about half that in the equation employing nominal per capita income, presumably reflecting different occupational mix, or some other source of real income differences. In Appendix table 3, the eastern Kentucky dummy coefficient implies that the region's base per capita income in the absence of coal production is only 5/8 of that in the non-coal-producing areas. The western Kentucky effect, on the other hand, shows a base income almost 10 percent above that of the nonproducing areas, again demonstrating that poverty in Kentucky coal production seems concentrated in the eastern area. Coal production is estimated to have a greater impact, per ton produced, on eastern than on western income. This is based on the region's respective coefficients of 22.08 and (22.08 - 2.30) = 19.78. The price of eastern Kentucky coal per ton, deflated by the 1981 CPI, rose from $15.75 to $30.72 from 1970 to 1981, while that of Western coal rose from $9.87 to $27.66 during the same period. The predicted consequence was approximately a 12 percent increase in income in both areas. Finally, an increase in the percentage of underground production adds to income, perhaps because costs of underground mining are higher, no doubt because of added risks, including accidents and Black Lung disease. As an incidental note, it seems worth remarking that U.S. Black Lung payments in 1973 were 1.05 billion dollars, contrasted to a total value of coal production at the mine of 5.0 billion dollars. In 1981, Black Lung payments were 1.725 billion dollars, while production at the mine was valued at 21.52 billion. When initiated, Black Lung payments were made out of general tax revenues; currently, new cases are covered by payments from a trust fund based on a tax on coal.[54] Hence, there has been an "internalization" of the assigned external cost of the disease.

Appendix table 4 exhibits reference data on 1973 and 1981 population by location category, including the Brown-Hines codes and the market area size classes. Total population within each category is shown in that table.

Appendix Table 4. Population Measures

Population Category	Population in thousands 1973	1981
U.S.	211,349.2	229,306.4
Metro	153,767.9	165,409.4
Nonmetro	57,581.3	63,897.6
Brown Hines Codes		
0	60,112.5	61,407.9
1	26,857.3	30,051.7
2	48,315.4	53,093.6
3	18,482.7	20,856.8
4	14.607.4	16,254.0
5	7,719.5	8,501.9
6	14,473.7	16,170.4
7	13,761.7	15,105.4
8	2,548.1	2,941.4
9	4,470.9	4,924.4
Market Areas		
1	17.2	16.0
2	166.1	153.9
3	761.1	681.0
4	3,794.8	3,416.5
5	15,205.6	15,098.4
6	16.568.2	17,586.1
7	16,188.8	18,689.0
8	21,290.7	22,492.6
9	22,099.8	24,651.1
10	27,090.3	30,226.8
11	78,412.4	87,155.6
12	9,754.2	9,139.9

Notes

1. The work on the project has been supported by a grant from the Ford Foundation to Resources for the Future.

2. Luther Tweeten, "Employment," in Don A. Dillman and Daryl J. Hobbs, eds., Rural Society in the United States, Boulder, Colorado: Westview Press, Inc., 1982, p. 138.

3. Dorothy M. Gilford, "Statistics for Rural Development Policy," Statistical Reporter, Nov. 1981, p. 39.

4. Russell Holden, Laurie Tobias, and Richard Wertheimer II, Differences in Living Costs Between Rural and Urban Areas, Final Report, Washington, D.C.: The Urban Institute, 1980.

5. Vinod Thomas, "Spatial Differences in Poverty: The Case of Peru," Journal of Development Economics, vol. 7, 1980, pp. 85-98; Vinod Thomas, "Spatial Differences in the Cost of Living," Journal of Urban Economics, vol. 8, 1980, pp. 108-22; and Vinod Thomas, Differences in Income, Nutrition and Poverty Within Brazil, World Bank Staff Working Paper no. 505, and draft revision, Washington, D.C., 1982.

6. Some examples of the BLS level-of-living index appear in Phyliss Groom, "A New City Worker's Family Budget," Monthly Labor Review, Nov. 1967, pp. 1-8; Jean C. Brackett, "New BLS Budgets," Monthly Labor Review, April 1969, pp. 3-16; and BLS, Handbook of Labor Statistics, 1974, Bulletin 1825, 1974, pp. 340-345.

7. Brackett, "New BLS Budgets," p. 14.

8. Statistical Policy Division, Office of Management and Budget. "Framework for Planning U.S. Federal Statistics, 1978-1989 (Draft Chapters)--Price Statistics," Statistical Reporter, September 1977, pp. 562 and 563.

9. Robert A. Hoppe, Effects of Geographic Cost of Living Adjustments on Welfare Benefits, USDA, ESCS, Rural Development Research Report No. 16, Washington, D.C., 1979, p. 4.

10. Gilford, "Statistics for Rural Development Policy," p. 39.

11. Telephone conversation with Vincent Adams, BLS, May, 1983.

12. Telephone conversation with Eva Jacobs, BLS, May, 1983.

13. William Alonso, "The Economics of Urban Size," Regional Science Association Papers, vol. xxvi, 1971; Victor R. Fuchs, Differentials in

Hourly Earnings by Region and City Size, 1959, Occasional Paper 101, New York: National Bureau of Economic Research, 1967; Irving Hoch, "Income and City Size," Urban Studies, Oct. 1972; Irving Hoch, "City Size Effects, Trends and Policies," Science, Sept. 3, 1976, pp. 856-863; Oded Izraeli, "Differentials in Nominal Wages and Prices Between Cities," Urban Studies, vol. 14, Oct. 1977; John R. Meyer and Robert A. Leone, "The Urban Disamenity Revisited," in L. Wingo and A. Evans, eds., Public Economics and the Quality of Life, Baltimore: Johns Hopkins Press for Resources for the Future, 1977, pp. 66-91; William D. Nordhaus and James Tobin, "Is Growth Obsolete?" in National Bureau of Economic Research, 50th Anniversary Colloquium, vol. 5, Economic Growth, New York: NBER, 1972; Thomas M. Power, "Urban Size (Dis)amenities Revisited," Journal of Urban Economics, vol. 9, Jan. 1981; and George S. Tolley, "The Welfare Economics of City Bigness," Journal of Urban Economics, vol. 1, July 1974.

14. M.L. Cropper and A.S. Arriaga-Salinas, "Inter-city Wage Differentials and the Value of Air Quality," Journal of Urban Economics, vol. 8, Sept. 1980, 236-254; V. Kerry Smith, "The Role of Site and Job Characteristics in Hedonic Wage Models," Journal of Urban Economics, vol. 13, May 1983, 296-321; and Irving Hoch, "Urban Scale and Environmental Quality," in Commission on Population Growth and the American Future, Research Reports, vol. III, Population, Resources and the Environment, edited by Ronald Ridker, 1972, pp. 235-284.

15. Brady J. Deaton, Larry C. Morgan, and Kurt R. Anschel, "The Influence of Psychic Costs on Rural-Urban Migration," American Journal of Agricultural Economics, vol. 64, no. 2, May 1982, pp. 177-187; Joe B. Stevens, "The Demand for Public Goods as a Factor in the Nonmetropolitan Migration Turnaround," in David L. Brown and John M. Wardwell, eds., New Directions in Urban-Rural Migration, New York: Academic Press, 1980; and Joe B. Stevens, "The Demand for Public Goods as Revealed Through Migration to Southern Oregon: A Progress Report," Oregon Agricultural Experiment Station Technical Paper, 1982.

16. Irving Hoch, "Settlement Size, Real Income and the Rural Turnaround," American Journal of Agricultural Economics, vol. 61, no. 5, Dec. 1979, pp. 953-959.

17. The Gilford report argues: "The county is a logical building block because of its common use in reporting data." Dorothy M. Gilford, "Statistics for Rural Development Policy," p. 35.

18. The data appear on a computer tape of the 1970 Census Fourth Count Population Employment Count Extract File. See U.S. Bureau of the Census, Census of Population: 1970, General Social and Economic Characteristics, Final Report PC (1)-C1, U.S. Summary and Individual States, Appendix D, for information on that tape.

19. Personal communication from U.S. Census official, January, 1983.

20. The 21 states were Ala., Ark., Conn., D.C., Fla., Ida., Ill., Ind., Ky., Me., Md., Minn., N.H., N.J., N.M., Ore., S.C., Tenn., Utah, Va., Wyo. Several other states replied to the requests for information but did not have salary schedule information available.

21. Educational Research Service, Inc., ERS Report: Scheduled Salaries for Professional Personnel in Public Schools, 1979-80, Part 1, Arlington, Va., 1980.

22. The county in which each school district was located was obtained from Curriculum Information Center, C.I.C. School Directory, 1980-81, Westport, Conn.: Market Data Retrieval, Inc., 1980.

23. The data were obtained on computer data tape and correspond to information appearing in the International City Management Association, Municipal Yearbook, 1979, Washington, D.C.

24. Wyoming Education Association, 1975-1976 Salary Research Bulletin, Casper, Wyoming, pp. 4, 16 and 24.

25. Donald C. Dahmann, "Subjective Assessments of Neighborhood Quality by Size of Place," Urban Studies, vol. 20, no. 1, Feb. 1983, pp. 31-46.

26. Ibid, p. 36.

27. T.W. Schultz, The Economic Organization of Agriculture, New York: McGraw-Hill, 1953. See G. Edward Schuh's discussion of the hypothesis in his "Neoclassical Economic Theory, Poverty and Income," in Robert O. Coppedge and Carlton G. Davis, eds., Rural Poverty and the Policy Crisis, Ames: Iowa State University Press, 1977.

28. A detailed discussion of the Southern differential appears in Irving Hoch, "Variations in the Quality of Life Among Cities and Regions," in L. Wingo and A. Evans, eds., Public Economics and the Quality of Life, Baltimore: Johns Hopkins Press for Resources for the Future, 1977, pp. 30-33, in particular, and Robert S. Goldfarb, A.M.J. Yezer and S. Crewe, "Some New Evidence: Have Regional Wage Differentials Really Disappeared?," Growth and Change, vol. 14, no. 1, Jan. 1983, pp. 48-51.

29. As an example of the point at issue, Bradshaw and Blakely argue that in spite of growth in rural employment, "rural earnings still lag considerably behind urban earnings," in Ted K. Bradshaw and Edward J. Blakely, "The Changing Nature of Rural America," Policy Studies Review, vol. 2, no. 1, August, 1982, p. 16. The contrasting position here is that, in real terms, rural earnings lag somewhat behind urban earnings.

30. Donald C. Dahmann, "Subjective Assessments...," p. 32. He includes the now classic study by Zuiches and Fuguitt. See J.J. Zuiches and G.V. Fuguitt, "Residential Preferences: Implications for Population Redistribution in Nonmetropolitan Areas," in Commission on Population Growth and the American Future, Population Distribution and Policy, 1972.

31. For example, see Edward F. Denison, "Explanations of Declining Productivity Growth," Survey of Current Business, August, 1979, vol. 59, no. 8, part II.

32. Definition and development of the codes appears in Fred K. Hines, David L. Brown, and John M. Zimmer, Social and Economic Characteristics of the Population in Metro and Nonmetro Counties, 1970, U.S. Department of Agriculture, Economic Research Service, AER 272, March, 1975.

33. A report to a government task force studying poverty concluded, "low income areas on average seem to have lower prices than more affluent areas. Unfortunately, given the difficulties of constructing reliable, accurate indices it is not possible to definitively quantify the extent to which such price differences neutralize income differences." This quotation appears in Urban Systems Research & Engineering, Inc., The Measure of Poverty, Technical Paper III, A Review of the Definition and Measurement of Poverty, Volume I: Summary Review Paper, U.S. Department of Health, Education and Welfare, 1976, p. 64. Mollie Orshansky stresses the measurement difficulties in "Measuring Poverty: A Debate," Public Welfare, Spring 1978, p. 49.

34. Joseph M. Dukert, "Who Is Poor? Who Is Truly Needy?," Public Welfare, Winter 1983, pp. 19, 22, in particular.

35. Carol Fendler and Mollie Orshansky, "Improving the Poverty Definition," 1979 Proceedings, American Statistical Association, Social Statistics Section, Washington, D.C., 1980, pp. 640-645, p. 641 in particular.

36. Robert A. Hoppe, "Effects of Geographic Cost of Living Adjustments on Welfare Benefits," pp. 7-15, in particular.

37. Ibid, 16.

38. Per capita county income data were obtained from a computer data tape of the U.S. Bureau of Economic Analysis, U.S. Department of Commerce.

39. The 1980 Census of Population data currently appear as unpublished data on a computer data tape obtained from the U.S. Census Bureau. The computer program to transform income distributions was written by Laurent R. Ross, who served as a consultant on this project.

40. The comparison drew on data in U.S. Bureau of the Census, Current Population Reports, Series P-60, No. 130, Characteristics of the Population Below the Poverty Level: 1979, 1981.

41. The data presented in this section were derived from a computer data tape containing unpublished data on transfer payments developed by the U.S. Bureau of Economic Analysis, U.S. Department of Commerce, and used in their regional income series.

42. Coal production data by county were obtained from James C. Currens and Gilbert E. Smith, Coal Production in Kentucky, 1790-1975, Lexington: Kentucky Geological Survey, University of Kentucky, Information Circular 23, 1977, and an update to 1980 from unpublished data obtained from the Kentucky Department of Energy.

43. Data were obtained from a computer data tape for the 1974 Census of Agriculture.

44. For example, see H. Gregg Lewis, Unionism and Relative Wages in the United States: An Empirical Inquiry, Chicago: University of Chicago Press: 1963, and Paul M. Ryscavage, "Measuring Union-Nonunion Earnings Differences," Monthly Labor Review, Dec. 1974.

45. Lawrence M. Kahn, "The Effect of Unions on the Earnings of Non-Union Workers," Industrial and Labor Relations Review, vol. 31, no. 2, Jan. 1978, pp. 205-216.

46. Barry M. Moriarty, "A Note on Unexplained Residuals in North-South Wage Differential Models," Journal of Regional Science, vol. 18, no. 1, 1978, pp. 105-108.

47. Both coefficients and t ratios increased for log of population and its square.

48. William Alonso, "Urban Disamenities," Society vol. 13, no. 4, May/June, 1976, pp. 51-53.

49. Most of Alonso's concerns appear to have been anticipated by Milton Friedman in his Price Theory, Chicago: Aldine Pub. Co., 1962, p. 223. He argues that except for isolated cases, geographic immobility is not much of a problem in the United States, documenting this by the great mobility of the population. He adds that "it is not necessary for everyone to move. Mobility at the margin is enough."

50. U.S. Bureau of the Census, Current Population Reports, Series P-20, no. 374, Population Profile of the United States, 1981, 1982, p. 11.

51. Larry H. Long, Interregional Migration of the Poor, U.S. Bureau of the Census, Current Population Reports Series P-23, no. 73, 1978, p. 9.

52. The exact measure for nonwhite acreage as a fraction of white was 0.328, from data in the 1974 Census of Agriculture.

53. David W. Norman and Emery N. Castle, "Geography and Agricultural Income: An Additional Hypothesis," Journal of Farm Economics, vol. 49, no. 2, 1967, pp. 571-583. Median earnings of farm operators and managers were related to a number of variables, including a climate measure accounting for both precipitation and sunlight. In both the Kansas and Oregon cases, improved climate was associated with lower earnings; the results for Kansas were statistically significant but those for Oregon were not.

54. Data on amount of Black Lung Disease payments from U.S. Bureau of Economic Analysis computer tape. Data on coal production from U.S. Bureau of Mines, Minerals Yearbook, 1973, vol. 1 p. 320, 1975, and Energy Information Administration, Coal Production, 1981, 1982, p. 30. Financing information from United Mine Workers of America, An Analysis of the Condition of the Black Lung Disability Trust Fund (Washington, D.C., 1982).

COMMENTS ON THE HOCH, HEWITT, AND VIRGIN PAPER

by Edna Loehman

The logic underlying the work of Hoch, Hewitt, and Virgin exhibits considerable merit; namely, if one is to understand the relationships between poverty and resources, one must first have an adequate definition of real income or "economic welfare." In turn, the definition of economic welfare should be in terms of more than just nominal income or wages.

Tobin and Nordhaus (1972) attempted to develop a measure of economic welfare more broadly defined than GNP on a national scale in order to compare economic welfare over time; their economic welfare measure included values for items such as nonmarket (household) activities, leisure, and disamenities. On a national level, these nonmarket values were shown to account for a magnitude roughly equal in value to the traditional national income and product measures. Hoch, Hewitt, and Virgin have attempted to develop a similar type of measure to compare economic welfare by labor market population, size, and location. The hope is that in using a measure of economic welfare, rather than nominal income, more equitable policies to alleviate poverty may be devised.

Although I agree in concept with their work, there are some issues of application. The following discussion of their very considerable effort will be in three parts:

1. conceptual basis
2. empirical problems
3. application to income/poverty/resources relationships.

Conceptual Basis

The basic assumption underlying hedonic studies (whether of wages or property values) is that "economic welfare" is determined by both market values and nonmonetary values such as climate, pollution, and crime rates. Different markets will have associated with them different levels of the nonmarket values.

Edna Loehman is Professor of Agricultural Economics at Purdue University.

Then because of mobility across markets: in equilibrium, economic welfare across markets will become equalized. That is, a location with lower amenities will have higher wages and conversely so that no location will produce a greater economic welfare than another. (Presumably, this equilibrium welfare is only achieved by workers with job mobility.) In figure 1, W^* denotes the equilibrium level of welfare. The welfare indicator W is defined in terms of wages, prices of consumption goods, and amenities and is held constant at W^* to produce an indifference surface: $W(w,p,A) = W^*$. Suppose two locations have amenity levels A_1 and A_2 respectively; then a wage rate difference $w^*_1 - w^*_2$ is needed to compensate for the lower amenity level in area 1 to maintain welfare W^*.

Aside from questions of mobility and existence of equilibrium, one problem in applying this conceptual framework to the poverty issue is that the equilibrium level of welfare is different from the poverty level of welfare.

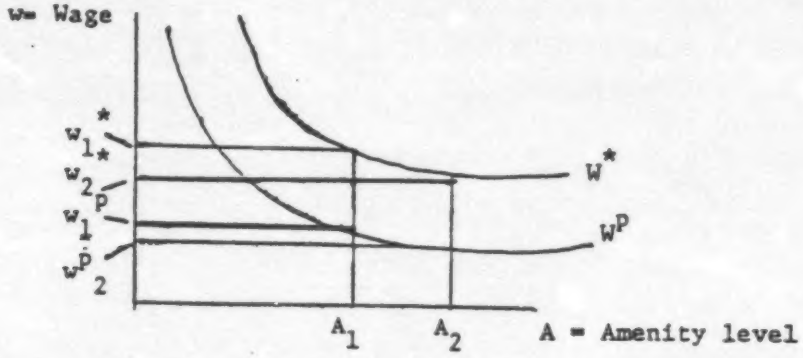

Illustration of wage-amenity relation

Figure 1

W^* may not be the welfare levels achieved by poverty-level individuals who lack mobility; let Wp denote welfare of such individuals. In figure 1, $w_1^P - w_2^P$ is the amount of income needed to compensate for the amenity difference holding welfare at W^P; this is not the same as $w_1^* - w_2^*$ unless the indifference curves are vertically parallel; thus, required compensation may differ from that predicted with an hedonic study.

A more basic problem is how to use information from hedonic studies to derive a welfare measure. The Hoch, et al. paper uses an income deflator

(a multiplicative correction); the following discussion shows the correction should be additive rather than multiplicative.

Let one labor market have poverty wages, prices, and amenities of (w_1, p_1, A_1) and another have (w_2p ,p_2, A_2). To equalize welfare at a common poverty welfare level W^p for the two locations, an amount x, added to wage income at location 1, should satisfy

$$W(w_1^p+x,p_1,A_1) = W(w_2^p, p_2,A_2)$$

$$\text{or } W_w(w_1^p+x-w^p{}_2)+w_p(p_1-p_2) + W_A(A_1-A_2) = 0$$

$$\text{or } x = (w_2^p-w_1^p) + \frac{W_p}{W_w}(p_2-p_1) + \frac{W_A}{W_w}(A_2-A_1)$$

Thus, if location two has the same cost of living, higher amenities, and higher wages than location one, x is a positive compensation added to income in location one to equalize welfare. Thus, the welfare correction includes wages, cost of living, and amenity values in an additive way.

To measure the ratios W_p/W_w and W_a/W_w needed to specify the correct compensation, the hedonic relationship can be used (making the assumption of vertically parallel indifference curves as discussed above).

Solving $W(w,p,A) = W^*$

implicitly for $w = f(p,A;W^*)$,

the implicit relationship will satisfy

$$W_w dw+W_p+W_A dA = 0$$

or

$$\frac{dw}{dp} = \frac{-Wp}{W_w}$$

$$\frac{dw}{dA} = \frac{-W_A}{W_w}$$

The estimated hedonic relationship can be used to obtain estimates of the required slopes of the indifference curves; note that the slopes are not constants but are functions of w,p,A.

Empirical Problems

To implement the computation of real income, a hedonic relationship between wages and cost of living and amenities is needed. One criticism of the wage relationship estimated by Hoch, et al. is that only population and location are used as measures of amenities. There is thus a problem of misspecification when applying the derived income correction; for example, Seattle and Boston are cities which would exhibit good environmental quality in spite of being large.

A second problem of estimation has to do with misspecification caused by data problems. Because of the secondary nature of the wage rate data, several categories of occupations used by Hoch, et al. are very broad (for example, professionals, craftsmen, laborers, and the like) and thus not really homogeneous. Mobility, the basic assumption required by the hedonic method, may differ within a category. As an illustration of the problem, a recent wage rate study (Getz and Huang, 1978) obtained the result that air pollution had a significant effect on wages of professional workers but not on wages for managers, sales people, and "all occupations"; it might be hypothesized that professionals have more mobility than other categories of workers. The solution of this data problem is to obtain wage rate data for more narrowly defined categories and include a mobility factor in the equation specification, for example, unemployment rate for the occupation category.

Another data problem has to do with "quality" of labor; Hoch et al. attempted to correct for this by using salary schedules but some more specific measures of quality would be preferred; for example, a variable measuring years of experience, education, and the like. Again, to improve the measurement of the hedonic relation, a more "micro" wage data set is needed.

Another type of empirical question has to do with application of the hedonic equation to find the appropriate income compensation. The Hoch et al. study defines an optimum amenity level as one corresponding to a contiguous nonmetropolitan location of size 10-25,000. There are two reasons given for this choice of base.

1. This type of area is most preferred as a place of residence according to cited studies of satisfaction.
2. Wages from several sources seem to exhibit a U-shaped relationship to population with a minimum at this size implying from the indifference curve (figure 1) that such a place has the highest amenity level.

Use of their income index (disregarding regional location) would result in deflating nominal wages for sizes both smaller and larger than this size because of the hypothesized U-shaped relationship between wages and population. Establishment of the U-shape seems somewhat ad hoc and I am also not quite sure of the logic behind connecting the regional dummy variables to a multiplicative index. It seems that definition of such an optimum location is somewhat controversial and deserves more study.

According to the method presented in the previous section where income corrections are done in a different way, defining an "optimum" location is not necessary. To make the income correction one must only define a base location with an acceptable level of economic welfare for poverty (W^P) and make the additive connections to income for other places in the prescribed manner depending on whether wages, cost of living, and amenities are higher or lower than the base location. Obviously, there will be some politics involved in the definition of a place with the "acceptable" base welfare!

Poverty/Resource Relationships

The effort to define economic welfare measures seems important in and of itself, not just because of studying the relationship between resources and poverty. In fact, use of the index in the Hoch study does not seem to clarify the relation between poverty and resources.

A major problem with the hedonic approach (cited by Getz and Huang) is that it is a single equation approach which does not include production and wage determination. Therefore, it lacks the explanatory power to study the effect of an input (resources) on the marginal product of labor and hence wages.

Conclusions

The efforts begun in this paper are worthy and should be expanded; any criticisms merely imply the need for further work along these lines. The following recommendations summarize the points made above and could be used for a research agenda:

1. Develop further the conceptual framework for measurement of economic welfare and how to use such measures to make real income adjustments.
2. Develop a more "micro" data base for wages by occupation and location to obtain homogeneous categories with quality dimensions.
3. Using this data base, develop a more detailed hedonic wage model which includes (rather than population alone) specific measures of environmental amenities.
4. Develop a simultaneous equation framework which includes demand for inputs in addition to labor to study resource/income relationships.

References

Getz, M. and Y.C. Huang. 1978. "Consumer Revealed Preference for Environmental Goods," Review of Economics and Statistics, pp. 449-458.

Nordhaus, W.D. and J. Tobin. 1972. "Is Growth Obsolete," Economic Growth, Fifth Anniversary Colloquium V (New York, National Bureau of Economic Research).

Hoch, I. 1972. "Urban Scale and Environmental Quality" in Population, Resources, and the Environment (Washington, D.C., Commission on Population Growth and the American Future, Vol. III).